Disclaimer: Information contained in the report addresses environmental conditions only and is not the official South Florida Water Management District operations recommendation or decision.

M E M O R A N D U M

TO: John Mitnik, Chief, Operations, Engineering and Construction Bureau
Paul Linton, Chief, Operations Section

FROM: SFWMD Staff Environmental Advisory Team

DATE: May 28, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A dry start to the week, then below-average shower and thunderstorm activity returning later this week. Southeasterly winds are starting to increase surface humidity across the District but deep-layered high pressure over the area will continue to suppress shower development over the District today and Wednesday. As the high-pressure ridge begins to weaken and shift to the southeastern Gulf of Mexico, daytime heating should begin to squeeze out some limited daily shower activity Thursday and Friday. Moisture is then forecast to improve as a mid-level trough pushes into central Florida which should increase daily shower and thunderstorm development Saturday, Sunday, and Monday, but overall daily shower coverage should remain well below the historical average for the beginning of June.

Kissimmee

Tuesday morning stages were 55.1 feet NGVD (0.1 feet below schedule) in East Lake Toho, 52.1 feet NGVD (0.1 feet below schedule) in Toho, and 49.0 feet NGVD (0.1 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.4 feet NGVD at S-65A and 25.8 feet NGVD at S-65D. Tuesday morning discharges were 400 cfs at S-65, 294 cfs at S-65A, 425 cfs at S-65D and 230 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 6.1 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.07 feet. There were no new recommendations this week.

Lake Okeechobee

Lake Okeechobee stage is 10.99 feet NGVD, decreasing 0.22 feet from the previous week and 0.32 ft from the previous month. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.43 feet above the Water Shortage sub-band. The lake remains below the bottom of the ecological envelope (currently 1.01 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. Given that the wet season is predicted to start in the next few weeks, and the condition of SAV and EAV in the nearshore zone is slowly improving, these lower lake stages are ideal for vegetation recovery. However, low stages will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh. Estimated algal bloom potential using satellite imagery suggests the area of medium bloom risk in the north of the lake and along the western shore has widened slightly, particularly around Fisheating Bay and near the mouth of the Kissimmee River.

Estuaries

Total inflow to the St. Lucie Estuary averaged 170 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinities increased slightly in the estuary. The seven-day average salinity at the US1 Bridge is within the good range for adult eastern oysters.

Total inflow to the Caloosahatchee Estuary averaged 724 cfs over the past week with 458 cfs coming from the Lake. Over the past week, salinity increased throughout the estuary. The 30-day moving average surface salinity is 1.2 at Val I-75 and 7.0 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the good range for adult eastern at Cape Coral and Shell Point, and in the fair range at Sanibel. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to the areas further downstream.

Stormwater Treatment Areas

Over the past week, approximately 400 acre-feet of Lake water was delivered to the STAs to maintain target stages. The total amount of Lake releases sent to the STAs/FEBs in WY2020 (since May 1, 2019) is approximately 5,700 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 82,000 acre-feet. Most STA cells are at or above target depths. STA-1W Northern Flow-way is offline for STA-1W Expansion project construction activities, STA-1E Western Flow-way is offline for levee repairs in the West Distribution Cell, and STA-5/6 Flow-ways 2 and 3 are offline for the Restoration Strategies project to grade non-effective treatment areas. Operational restrictions are in place in STA-5/6 Flow-ways 1 and 4 to facilitate the Restoration Strategies grading project in Flow-ways 2 and 3. The nest of an Endangered Species Act (ESA) protected species has been observed in STA-1E and the nests of Migratory Bird Treaty Act (MBTA) protected species have been observed in STA-1E and STA-5/6. It is recommended that no Lake regulatory releases be sent to the STAs this week.

Everglades

Ecological areas of concern remain the foraging conditions in WCA-2A and WCA-3A South and peat soils / fire risk in northern WCA-3A. Stage conditions on average were categorized as poor for wading bird foraging within WCA-2A over the last week and fair in WCA-3A and WCA-1. Water depths in Taylor Slough and the ENP panhandle decreased this week, with the marsh area averaging a depth of 0.13 feet. Salinities in Florida Bay and in the mangrove zone (Florida Bay MFL) increased on average last week. Conditions remain good for Cape Sable Seaside Sparrow nesting, sub pop “D” nesting and fledging success remains above average. CSSS were noted in sub pop “A” for the first time this year.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.01 inches of rainfall in the past week and the Lower Basin received 0.04 inches (SFWMD Daily Rainfall Report 5/27/2019).

Upper Kissimmee Basin

Stages and departures in the Kissimmee Chain of Lakes (KCOL) are shown in **Table 1**. KCOL stage hydrographs with respective regulation schedules and rainfall are shown in Figures 1-7.

Table 1. Average discharge (cfs) for the preceding seven days, one-day stage (feet NGVD), and departures from KCOL flood regulation (R) or temporary schedules (T, A, or S). Provisional, real-time data are from SFWMD.

Report Date: 5/28/2019

Water Body	Structure	7-day Average Discharge (cfs)[1]	Stage Monitoring Site[2]	Lake Stage (feet)	Schedule Type[3]	Schedule Stage (feet)	Daily Departure (feet)						
							5/26/19	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19	4/14/19
Lakes Hart and Mary Jane	S-62	3	LKMJ	59.5	R	59.6	**-0.1**	-0.2	-0.2	0.0	-0.2	-0.2	-0.3
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.0	R	60.1	**-0.1**	0.0	0.0	0.0	-0.1	-0.1	0.0
Alligator Chain	S-60	25	ALLI	62.2	R	62.2	**0.0**	0.0	0.0	0.1	0.0	0.0	-0.1
Lake Gentry	S-63	27	LKGT	59.7	R	59.7	**0.0**	0.0	0.0	0.1	0.0	0.0	0.0
East Lake Toho	S-59	35	TOHOE	55.1	R	55.2	**-0.1**	-0.3	-0.5	-0.4	-0.7	-0.8	-1.0
Lake Toho	S-61	185	TOHOW, S-61	52.1	R	52.2	**-0.1**	-0.3	-0.4	-0.5	-0.7	-0.8	-1.0
Lakes Kissimmee, Cypress, and Hatchineha	S-65	596	KUB011, LKIS5B	49.1	R	49.2	**-0.1**	-0.1	-0.4	-0.5	-0.6	-0.7	-0.9

[1] Seven-day average of weighted daily means through midnight.
[2] Names of in-lake monitoring sites and structures used to determine lake stage; if more than one site is listed, an average is reported.
[3] A = projected ascension line, R = USACE regulation schedule, S = temporary recession target line, T = temporary schedule, N/A= not applicable or data not available.
DATA ARE PROVISIONAL

Lower Kissimmee Basin

Discharges at Lower Basin structures are shown in Table 2. SFWDAT depth maps for the Phase I restoration area are shown in Figure 8. Kissimmee River floodplain stages at selected stations are shown in Figure 9.

Table 2. One-day and seven-day averages of discharge at S-65x structures, of dissolved oxygen concentration in the Phase I area river channel, and water depth in the Phase I area floodplain. Data are provisional real-time data from SFWMD.

Report Date: **5/28/2019**

Metric	Location	1-Day Average	Average for the Preceeding 7-Days[1]									
		5/26/2019	5/26/19	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19	4/14/19	4/7/19	3/31/19	3/24/19
Discharge (cfs)	S-65	386	596	984	1,014	428	438	525	710	434	452	833
Discharge (cfs)	S-65A[2]	293	456	815	823	314	314	400	559	334	353	699
Discharge (cfs)	S-65D[2]	425	706	920	795	403	466	584	703	367	563	859
Headwater Stage (feet NGVD)	S-65D[2]	25.72	25.80	25.82	25.78	25.81	25.76	25.78	25.77	25.73	25.76	25.77
Discharge (cfs)	S-65E[2]	212	591	810	703	351	441	563	679	330	539	855
Discharge (cfs)	S-67	0	0	79	102	68	107	110	106	0	9	162
DO (mg/L)[3]	Phase I river channel	6.1	6.1	5.1	5.4	6.7	6.7	6.7	6.3	6.9	7.4	6.7
Mean depth (feet)[4]	Phase I floodplain	0.07	0.11	0.16	0.15	0.10	0.12	0.16	0.18	0.16	0.21	0.34

[1]Seven-day average of weighted daily means through Sunday midnight.
[2]S-65A discharge combines S-65A with auxillary strucutures; S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S-65D stage averages stage at S-65D and S-65DX1; S-65E discharge combines S-65E and S-65EX1.
[3]DO is the average for sondes at PC62 and PC33.
[4]1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).
DATA ARE PROVISIONAL; N/A indicates that data were not available.

KCOL Hydrographs (through Sunday midnight)

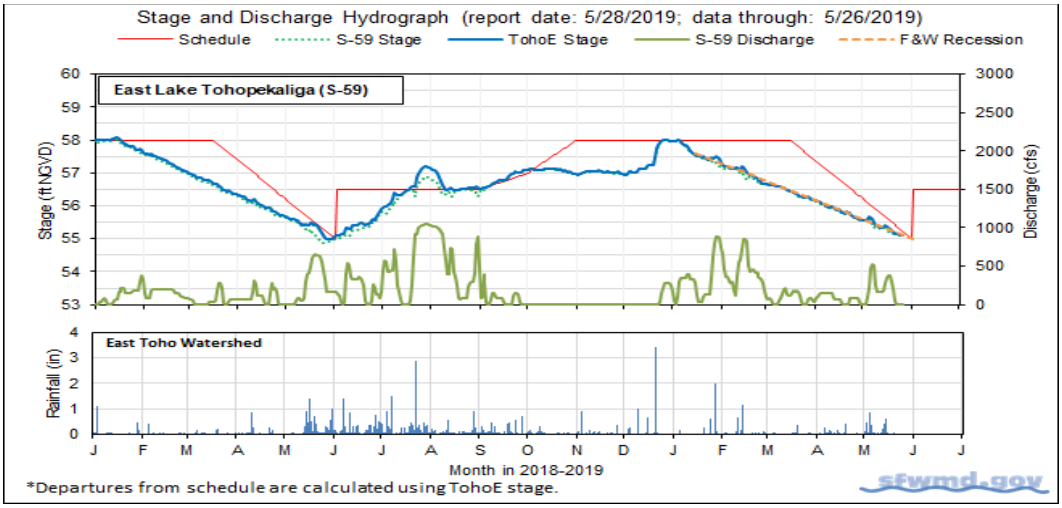


Figure 1.

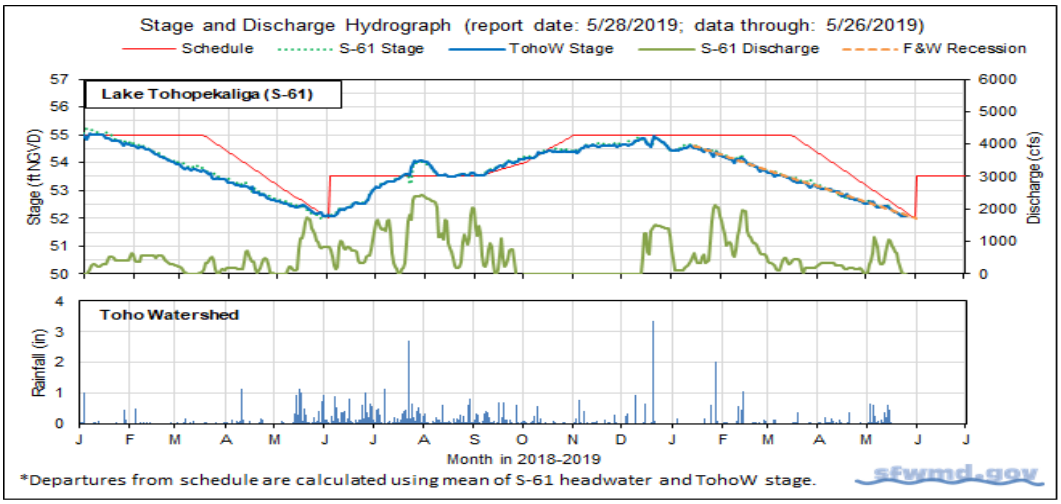


Figure 2.

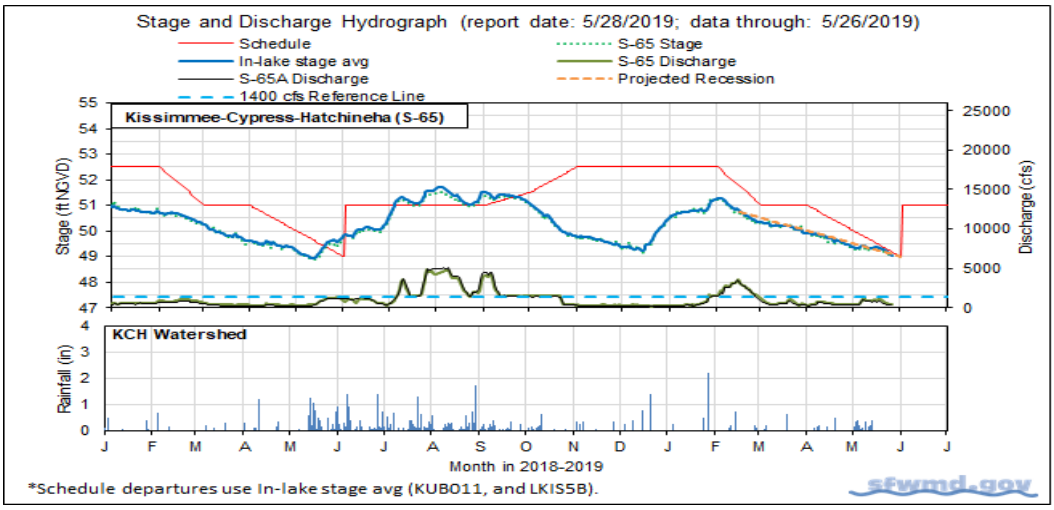


Figure 3.

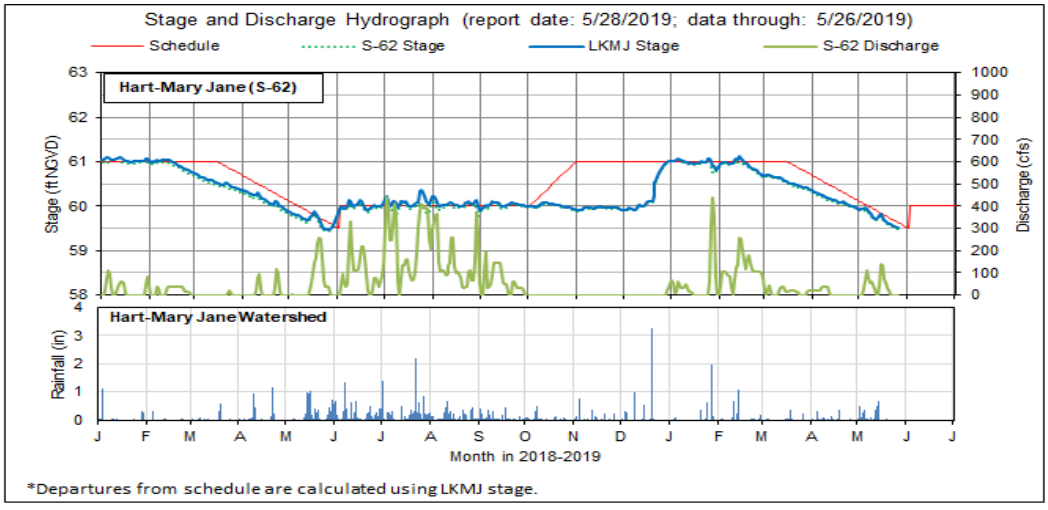


Figure 4.

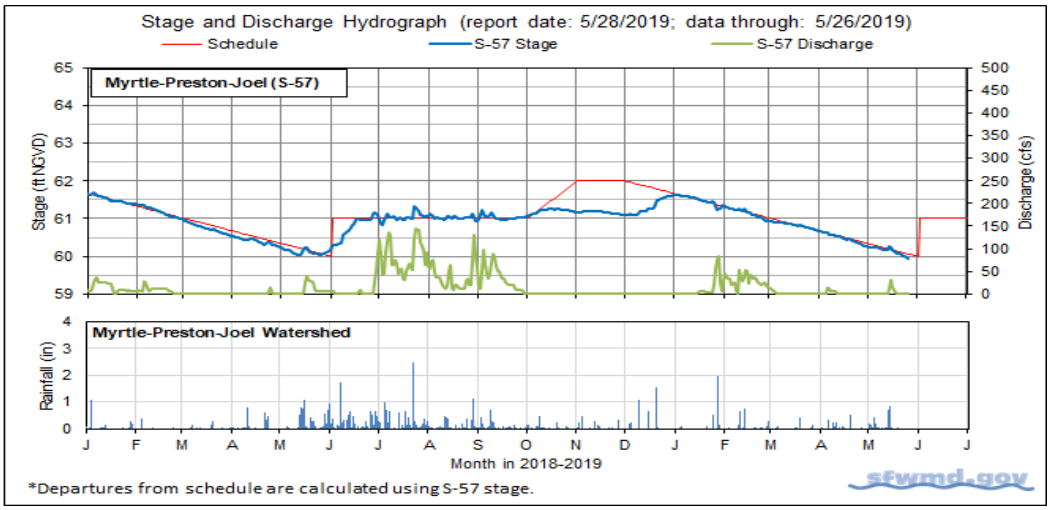


Figure 5.

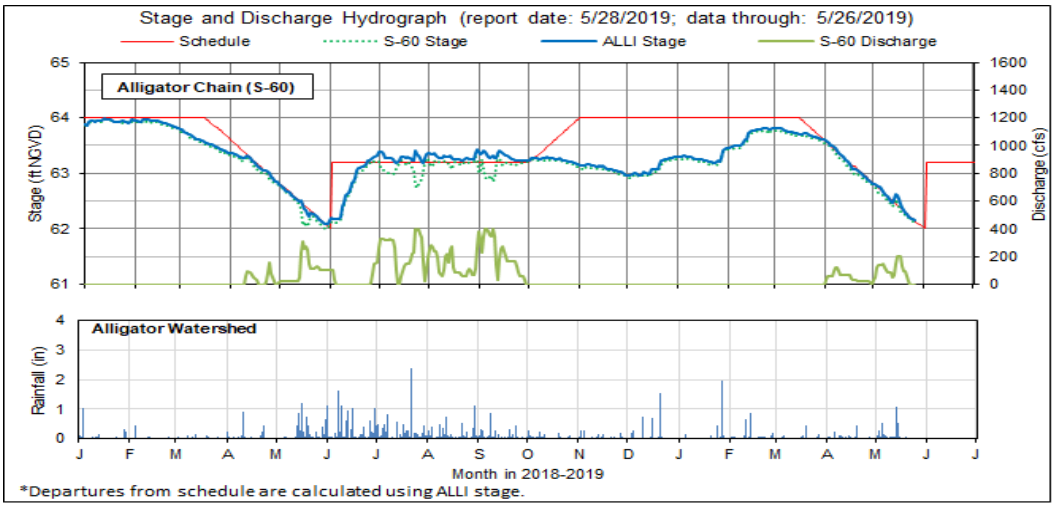


Figure 6.

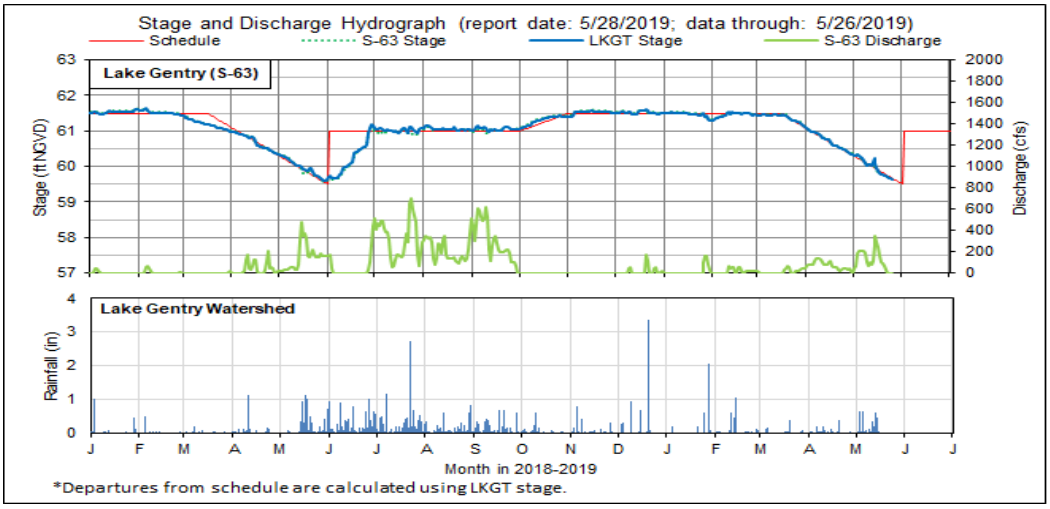


Figure 7.

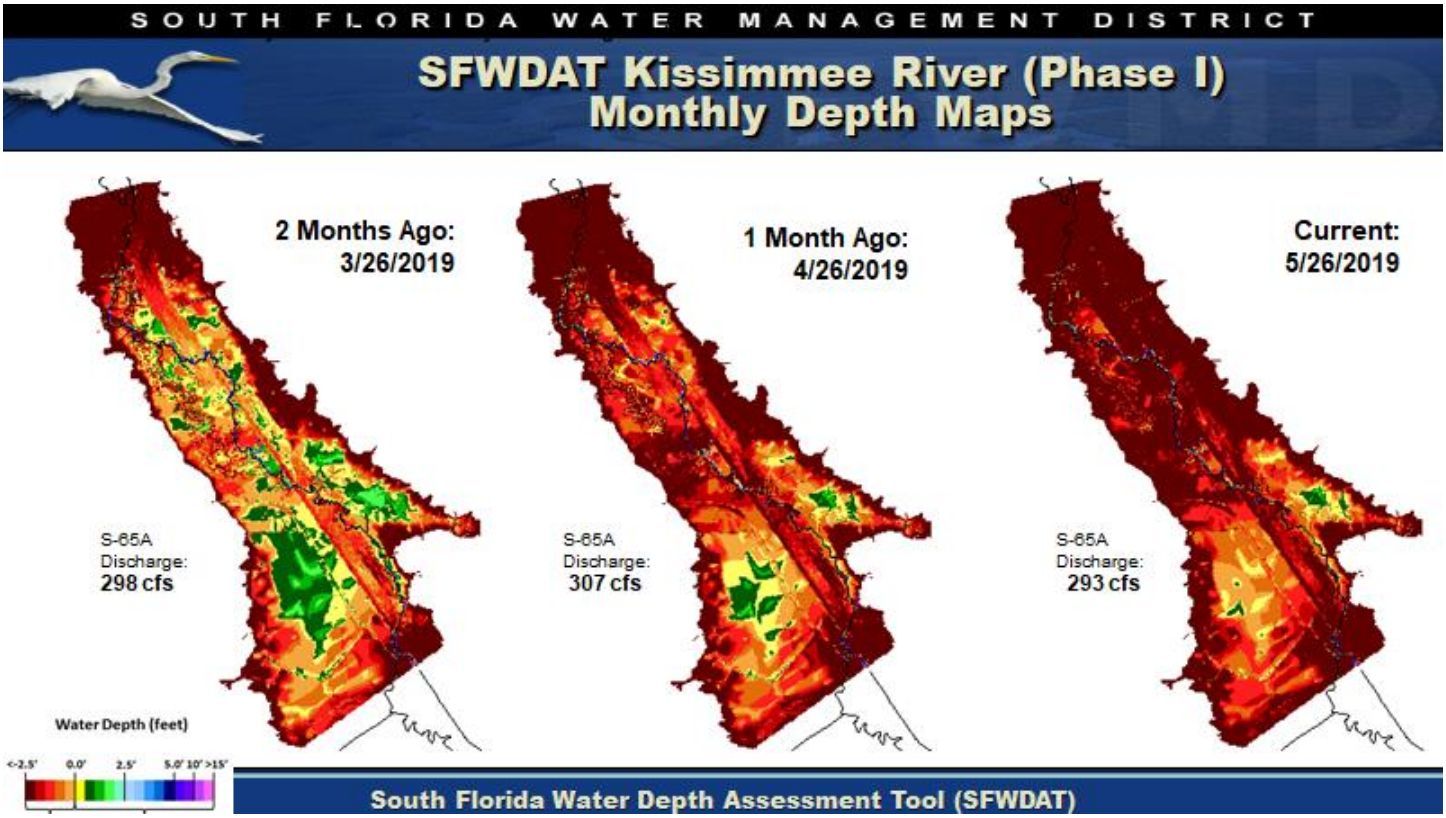


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

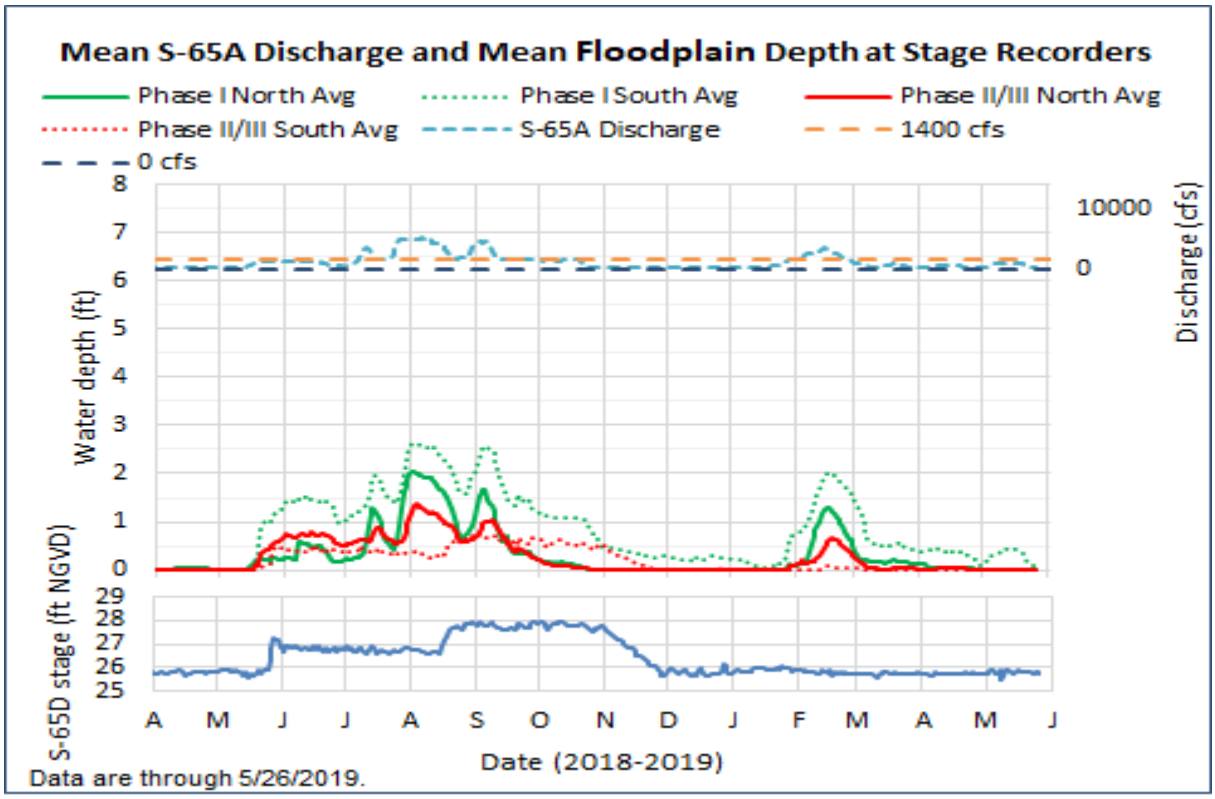


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.

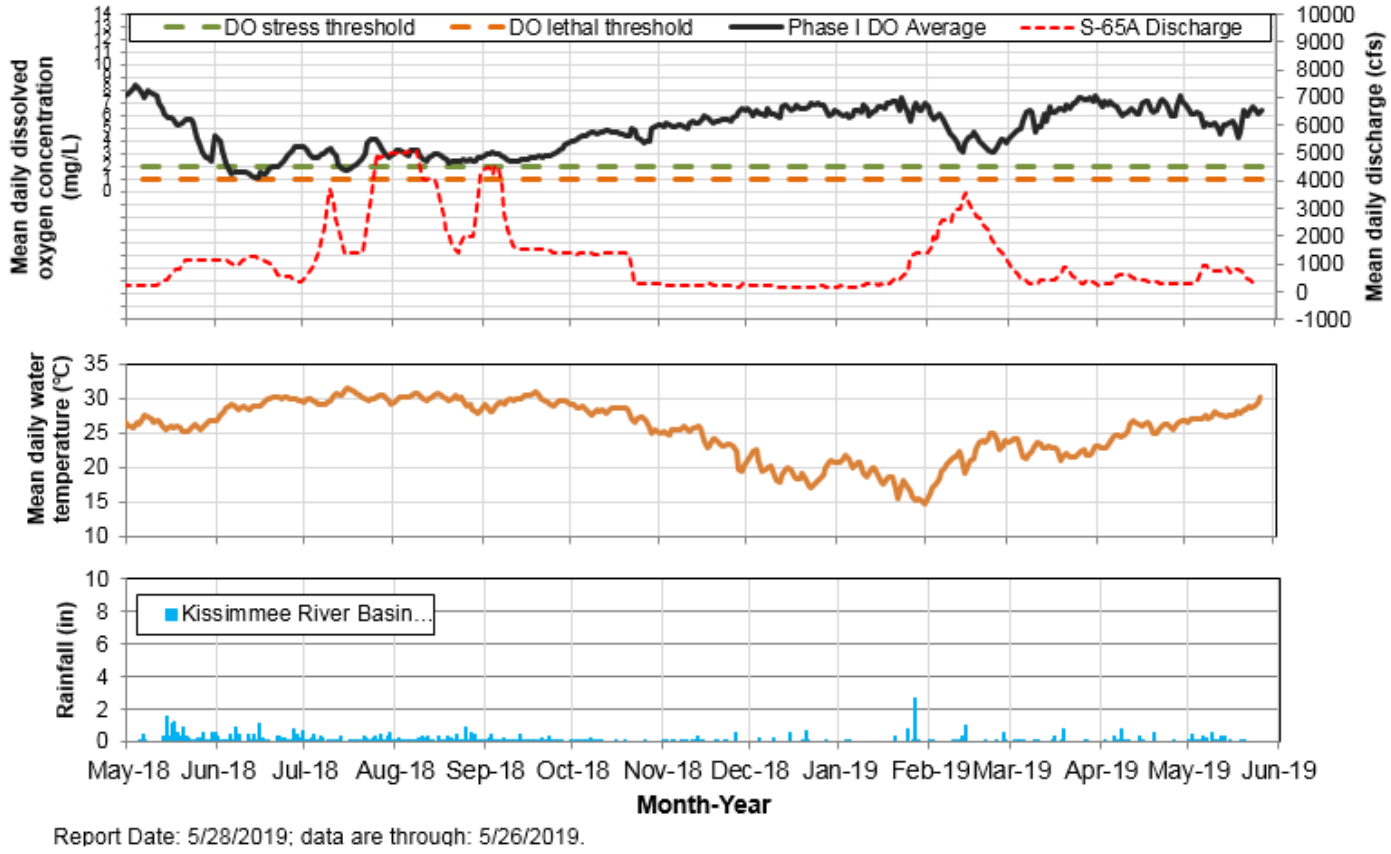


Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phase I river channel.

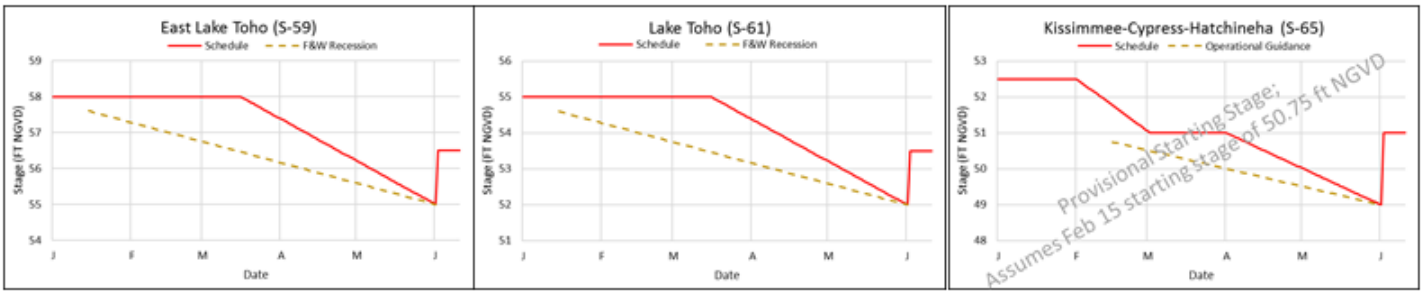
Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
5/28/2019	No new recommendations.		N/A		5/28/2019
5/20/2019	No new recommendations.		N/A		5/21/2019
5/13/2019	No new recommendations.		N/A		5/14/2019
5/6/2019	Due to the rainfall, increase S65-A to 1000 cfs today in two increments and increase flow at S-65 accordingly. We will reassess the rise in KCH stage tomorrow 5/7.	Short-term goals: try to keep S65-A discharge at or below 1000 cfs for KR fish sampling this week and next, while keeping the reversal in KCH less than about 0.4 ft.	Implemented	KB Ops	5/7/2019
4/29/2019	No new recommendations.		N/A		4/30/2019
4/23/2019	No new recommendations.		N/A		4/23/2019
4/15/2019	No new recommendations.		N/A		4/16/2019
4/8/2019	No new recommendations.		N/A		4/9/2019
4/1/2019	No new recommendations.		N/A		4/2/2019
3/25/2019	No new recommendations.		N/A		3/26/2019
3/18/2019	No new recommendations.		N/A		3/19/2019
3/11/2019	No new recommendations.		N/A		3/12/2019
3/4/2019	No new recommendations.		N/A		3/5/2019
2/26/2019	No new recommendations.		N/A		2/26/2019
2/19/2019	No new recommendations.		N/A		2/19/2019
2/10/2019	Increase discharge at S-65 by 600 cfs.	To compensate for increased inflow and rain forecast for Tuesday.	Implemented	KB Ops/SFWMD Water Mgt	2/12/2019
2/4/2019	Increase discharge at S-65/S-65A to begin reducing KCH stage to reach 50.75 ft on 2/15/2019.	Reduce to the stage at which the seasonal recession will begin.	Implemented	KB Ops/SFWMD Water Mgt	2/5/2019
1/26/2019	Increase S65A dishcarge by a total of 350 cfs today, which will put S65A at 1,400 cfs. Continue to increase discharge as needed.	Moderate or stop the rise in Lake KCH preemptively before forecast rainfall and provide capacity at S65A for S65A basin runoff.	Implemented	SFWMD Water Mgt/KB Ops	1/29/2019
1/22/2019	No new recommendations.		N/A		1/22/2019
1/15/2019	Begin recessions on Lake Toho and East Lake Toho on Jan 15, with a continuous recession to the regulation dry season low (52.0 ft on Toho; 55.0 ft on East Lake) on May 31. The lines are represented graphically in the Dry Season Operations slides. Tentatively plan on a recession in Kissimmee-Cypress-Hatchineha starting on February 15 with a continuous recession to the dry season low (49 ft) on May 31. A provisional diagram is included in the Dry Season Operations slides; however, starting stage may change depending on conditions. Discharge and reversal guidelines are provided in the Dry Season Operations slides.	Slow recession rates in East Toho, Toho, and KCH to benefit fish and wildlife; as possible limit flow volume at S-65D to facilitate KRR construction.	N/A	KB Ops	1/15/2019
1/4/2019	Discontinue 54 foot stage reduction target in Lake Toho.	Lake Kissimmee has already risen by ~1.5 ft.	Implemented	SFWMD Water Mgt/KB Ops	1/8/2019
12/14/2018	Manage S-61 discharge to reduce stage in Lake Toho to 54 ft over the next 7-9 days.	Move water to KCH to reduce the rate of stage decline in KCH; reduce the head difference between S-61 headwater and tailwater.	N/A	SFWMD Water Mgt/KB Ops	12/18/2018
12/10/2018	Reduce S-65A discharge to 180 cfs.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	N/A	SFWMD Water Mgt/KB Ops	12/11/2018
12/3/2018	No new recommendations.		N/A		12/4/2018
11/26/2018	No new recommendations.		N/A		11/27/2018
11/19/2018	No new recommendations.		N/A		11/20/2018
11/12/2018	No new recommendations.		N/A		11/13/2018
11/2/2018	Reduce S-65/S-65A discharge to approximately 250 cfs.	To conserve stage in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	11/6/2018
10/30/2018	No new recommendations.		N/A		10/30/2018
10/22/2018	Reduce S-65/S-65A discharge to approximately 300 cfs (minimum discharge) in one step of approximately 1100 cfs today.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	Implemented	SFWMD Water Mgt/KB Ops	10/23/2018
10/16/2018	No new recommendations.		N/A		10/16/2018
10/9/2018	No new recommendations.		N/A		10/9/2018
10/2/2018	No new recommendations.		N/A		10/2/2018
9/25/2018	No new recommendations.		N/A		9/25/2018
9/18/2018	No new recommendations.		N/A		9/18/2018
9/11/2018	No new recommendations.		N/A		9/11/2018
9/4/2018	No new recommendations.		N/A		9/4/2018
8/28/2018	No new recommendations.		N/A		8/28/2018

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Dry Season Operations Slide 1 - 2018-2019
(NOTE revised discharge table)



Other Considerations
- KCH starting stage may vary; the maximum is 50.75 ft NGVD on Feb 15.
- Maintain S65/S65A discharge of at least 300 cfs.
- If outlook is for extreme dry conditions meet with KB staff to discuss modifications to this plan.

Version 1: January 14 2019

Discharge Rate of Change Limits for S65/S65A (revised 1/14/19).

Q (cfs)	Maximum rate of INCREASE (cfs/day)	Maximum rate of DECREASE (cfs/day)
0-300	100	-50
301-650	150	-75
651-1400	300	-150
1401-3000	600	-300
>3000	1000	-1000

Figure 11A. Slide 1 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Dry Season Operations Slide 2 - 2018-2019

East Lake (ELT) and Toho (WLT)

- **East Toho and Toho Recessions:**
  - Make releases to begin recessions on Jan 15 with lake stage approximately 0.4 ft below winter pool and continue to follow straight line recessions through May 31st to the extent practical
- **East Toho and Toho Stage Reversals :**
  - Adjust discharge to bring stage back to the recession line within about a week
  - Pre-storm releases may be used to lower stage below the recession line and create storage of about half of the forecast rain volume
  - If stage cannot be brought back to the recession line within about a week, the recession line may need to be reset following discussion with partner agencies
  - In general, the water released from ELT and WLT basins will be released to KHC (to the extent that hydraulic capacity is available) without consideration for Lake KHC stage. However, the priority of KCH is subject to change if more nesting occurs in KCH than Toho or East

Kissimmee-Cypress-Hatchineha (KCH)

- **KCH Recession:**
  - Begin recession on February 15 (subject to change) starting no higher than 50.75 feet
  - To the extent feasible considering discharge constraints, make releases to follow a straight-line recession through May 31
  - In general, use the available storage in Lake KCH to keep flow at S-65D below 1,000 cfs; when possible keep flow below 600 cfs
- **KCH Stage Reversals :**
  - To address reversals, in general increase flow by 100 cfs for every 0.1 foot of rise above the recession line (e.g. from 300 cfs at the line to 800 cfs at 0.5 feet above the line)

Figure 11B. Slide 2 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

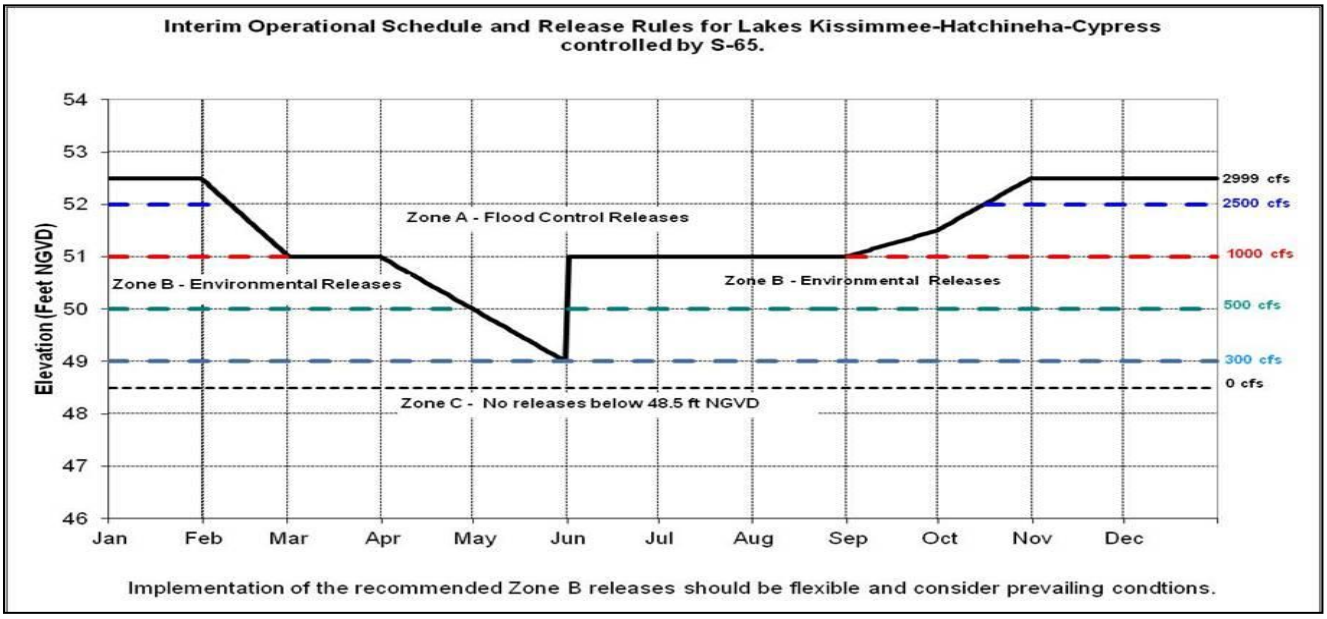


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

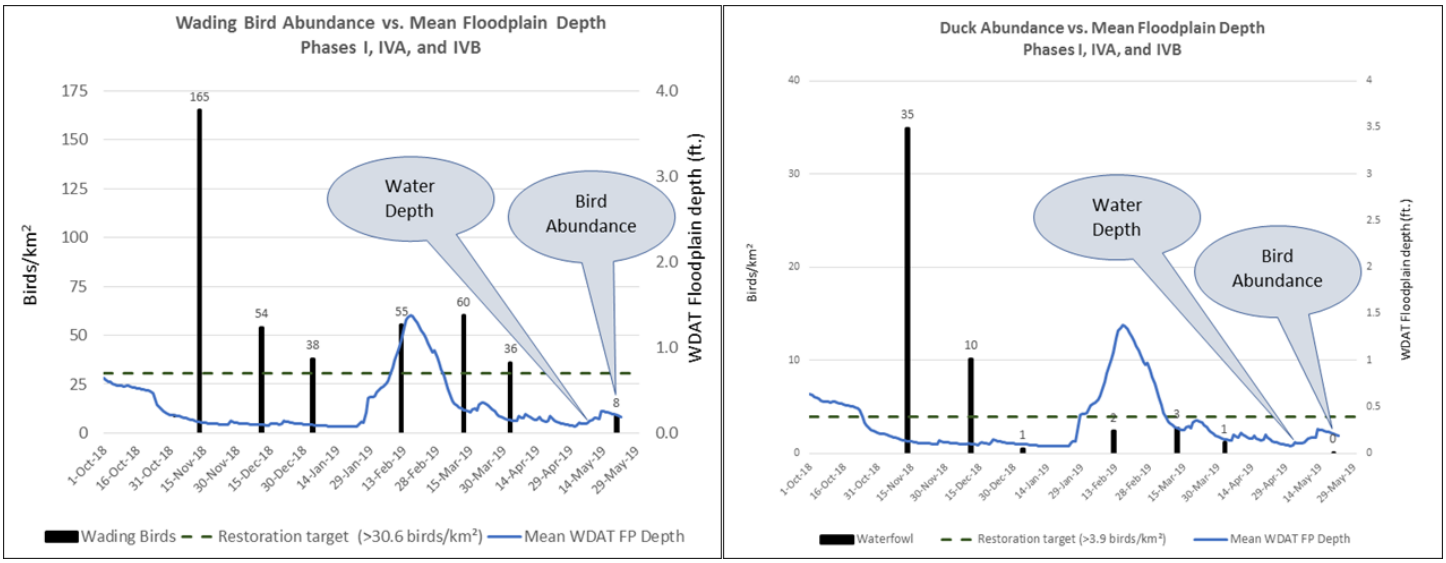


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to May 2019.

Table 3. Upper Kissimmee Basin Snail Kite Survey Update
Survey 4: May 19-21, 2019

WATERBODY	KITES	TOTAL NESTS	SUCCESSFUL	ACTIVE
East Toho	2	4	0	2
Toho	97	55	19	11
Kissimmee	225	55	7	30
KCOL Total	324	114	26	43

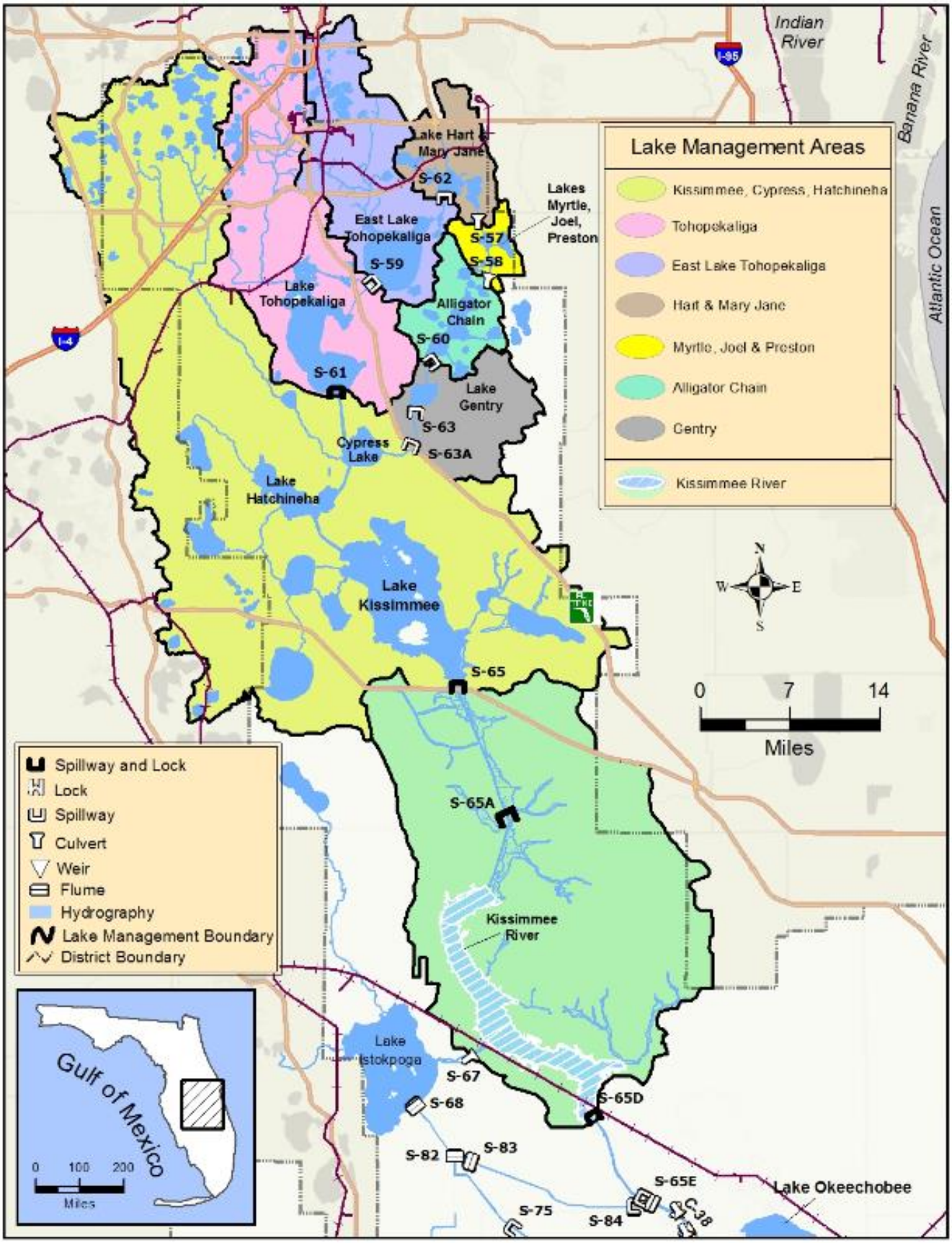


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 10.99 feet NGVD for May 28, 2019 decreasing 0.22 feet from the previous week. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and three perimeter stations (S-308, S-4 and S-133). The Lake is now 0.32 feet lower than a month ago and 2.91 feet lower than a year ago when stages were still recovering from Hurricane Irma (Figure 1). The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is currently 0.43 feet above the Water Shortage sub-band (Figure 2). Lake stage is similar to 2017, matching the lowest levels for this time of year since 2011 (Figure 3). According to RAINDAR, during the week of May 22 to May 27, 2019, no rain fell directly over the Lake. District-wide daily average rainfall was 0.02 inches. The majority of the rainfall occurred on May 22, while the subsequent 6 days were dry (Figure 4).

Average daily inflows (minus rainfall) to the Lake decreased this week from 951 cfs to 550 cfs. The inflows from the Kissimmee River decreased from 800 cfs to 543 cfs. Inflows from Lake Istokpoga into the Kissimmee River (via the S-84 structures) decreased from 110 cfs to 0. Inflows from S-71 and S-72 remained at 0 cfs. Fisheating Creek average daily inflow was 1 cfs (Table 1).

Total outflows (minus evapotranspiration) increased from the previous week, going from 302 average daily cfs to 1923 cfs this past week. (Table 1). Outflows south through the S-350s increased from 96 cfs to 1241 cfs. Outflows west via S-77 averaged 682 cfs, compared to the previous weeks 205 cfs. Outflows east via S-308 were zero again this week. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation was 0.18 inches this week.

Total lake inflows and outflows for the past week are detailed in Table 1, as well as the approximate change in lake stage from each major structure's total flows over the period. Figure 5 shows the combined average daily cfs for inflows and outflows for the Lake over the past eight weeks. These data are provisional and are subject to change.

The most recent satellite imagery (May 29, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel OLCI sensor data showed bloom potential is low for the Southern and Eastern regionsf of the Lake but is increasing and in the medium range along the north and western areas, particularly in and around Fisheating Bay and at the northern end of Indian Prairie (Figure 6). The color scheme that classifies algal densities in the image has changed, so direct comparison between the latest image and earlier images is more difficult.

Water Management Recommendations

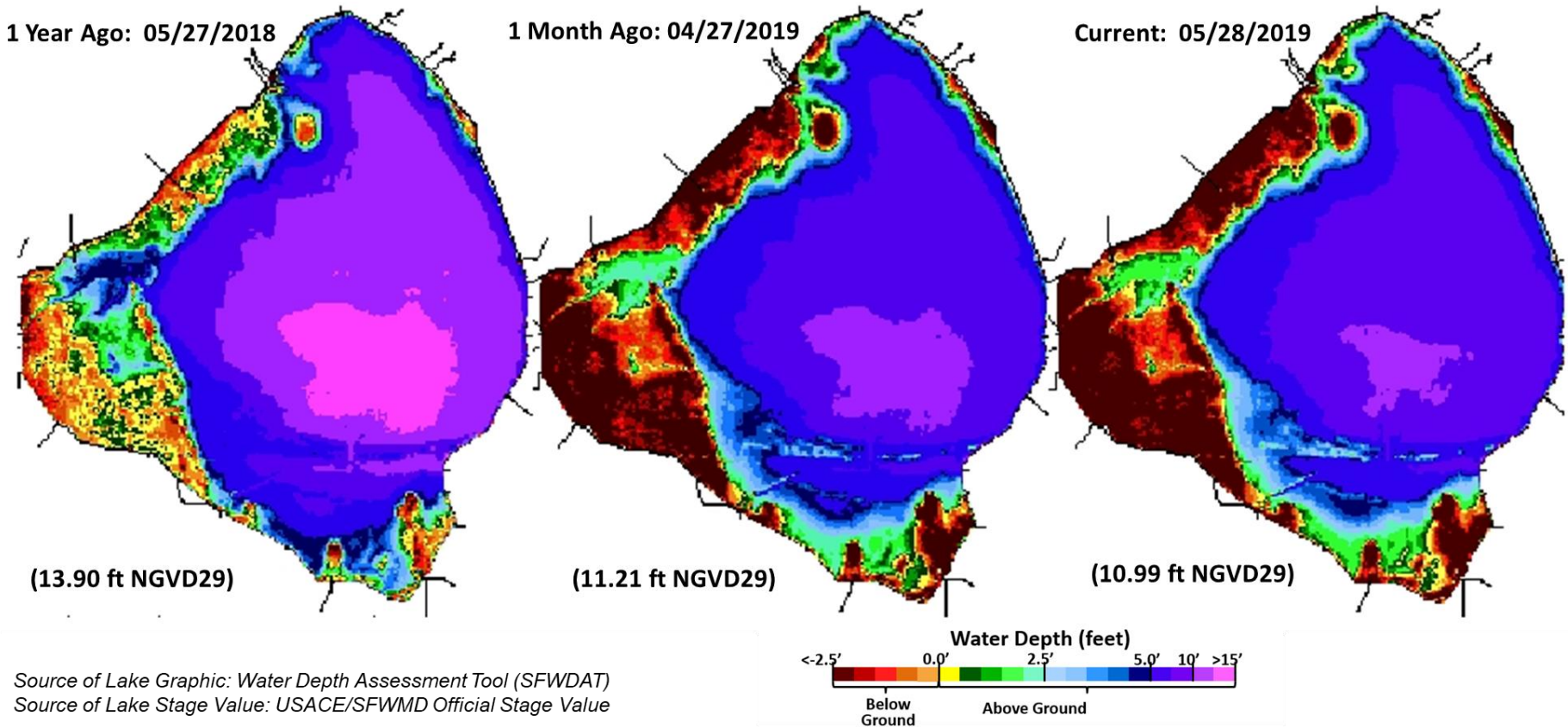
Lake Okeechobee stage is 10.99 feet NGVD, decreasing 0.22 feet from the previous week and 0.32 ft from the previous month. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.43 feet above the Water Shortage sub-band. The lake remains below the bottom of the ecological envelope (currently 1.01 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. Given that the wet season is predicted to start in the next few weeks, and the condition of SAV and EAV in the nearshore zone is slowly improving, these lower lake stages are ideal for vegetation recovery. However, low stages will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh. Estimated algal bloom potential using satellite imagery suggests the area of medium bloom risk in the north of the lake and along the western shore has widened slightly, particularly around Fisheating Bay and near the mouth of the Kissimmee River.

Table 1. Average daily inflows and outflows and the approximate depth equivalents on Lake Okeechobee for various structures.

INFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-65E & S-65EX1	800	543	0.3
S-71 & S-72	0	0	0.0
S-84 & S-84X	110	0	0.0
Fisheating Creek	3	1	0.0
S-154	0	0	0.0
S-191	0	0	0.0
S-133 P	0	0	0.0
S-127 P	0	0	0.0
S-129 P	0	0	0.0
S-131 P	0	0	0.0
S-135 P	0	0	0.0
S-2 P	0	0	0.0
S-3 P	0	0	0.0
S-4 P	0	0	0.0
L-8 Backflow	39	6	0.0
Rainfall	350	6	0.0
Total	**1301**	**556**	**0.3**

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	205	682	0.3
S-308	0	0	0.0
S-351	0	280	0.1
S-352	61	540	0.3
S-354	35	420	0.2
L-8 Outflow			
ET	2316	2621	1.3
Total	**2618**	**4544**	**2.2**

Provisional Data



Source of Lake Graphic: Water Depth Assessment Tool (SFWDAT)
Source of Lake Stage Value: USACE/SFWMD Official Stage Value

Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

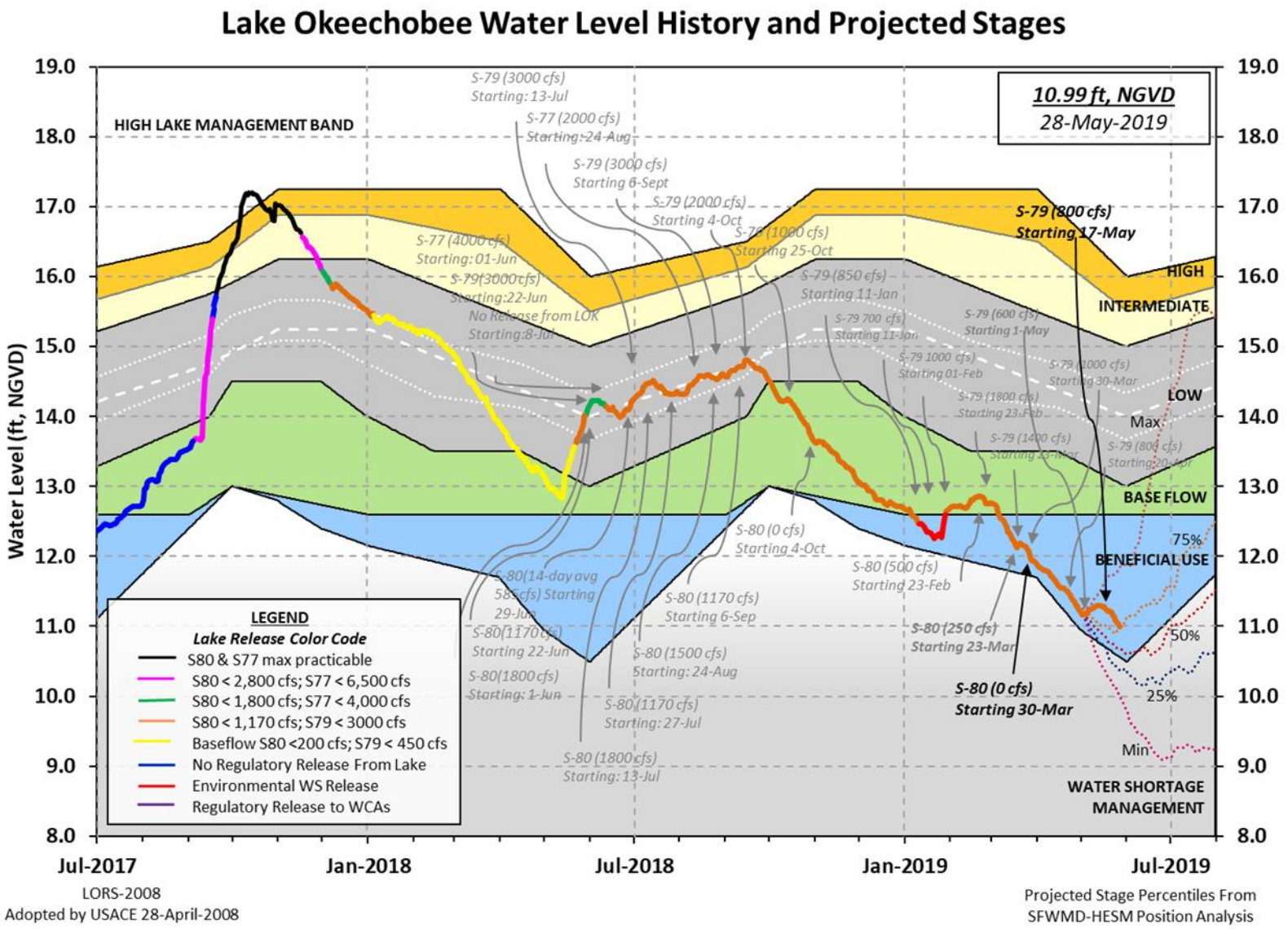


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

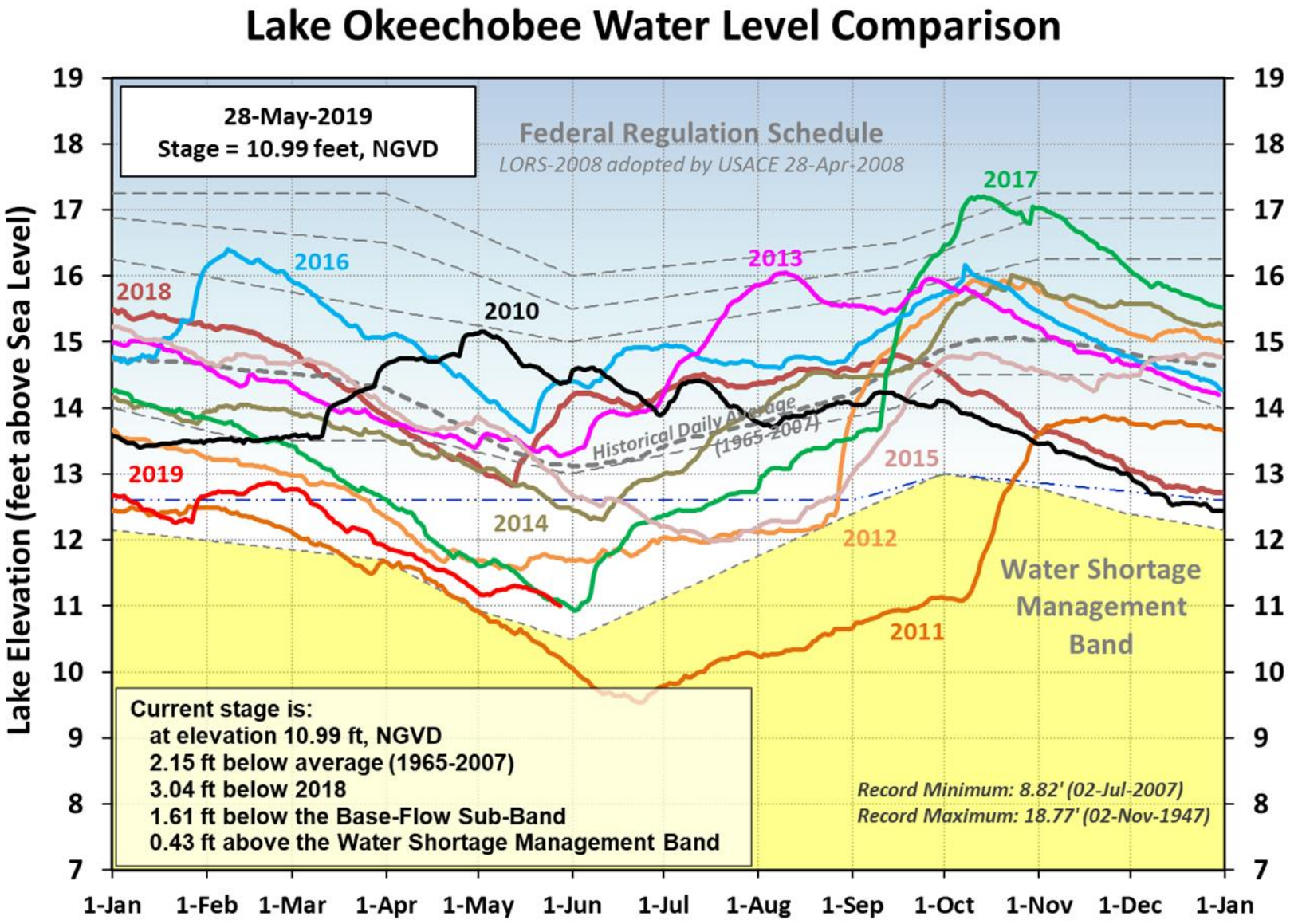


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

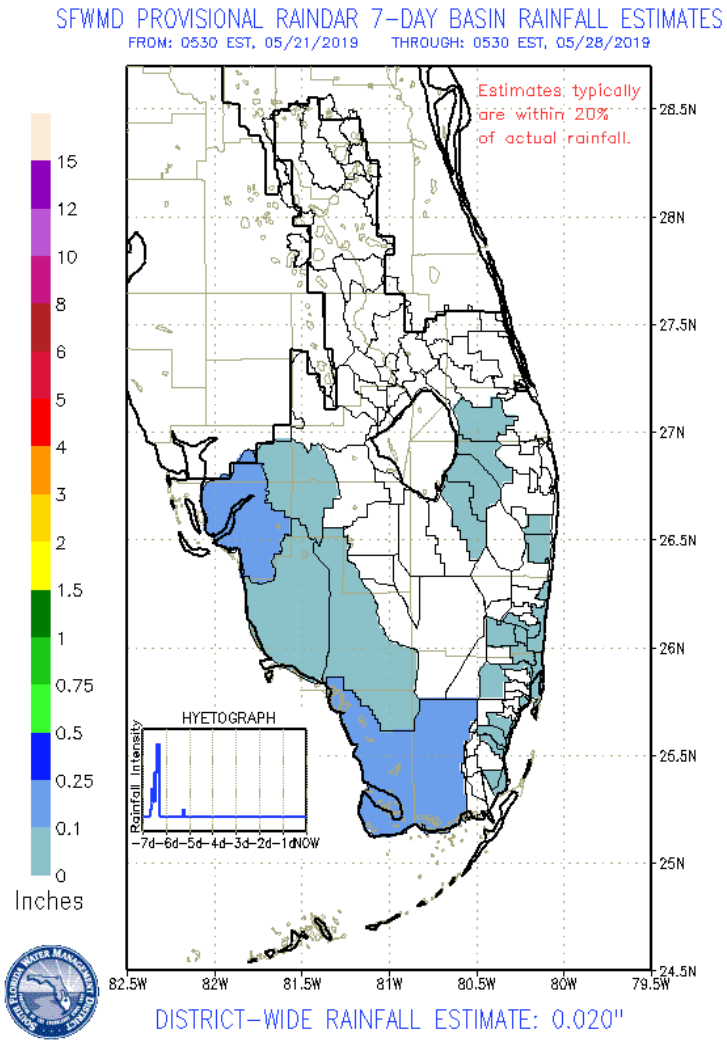


Figure 4. Rainfall estimates by basin.

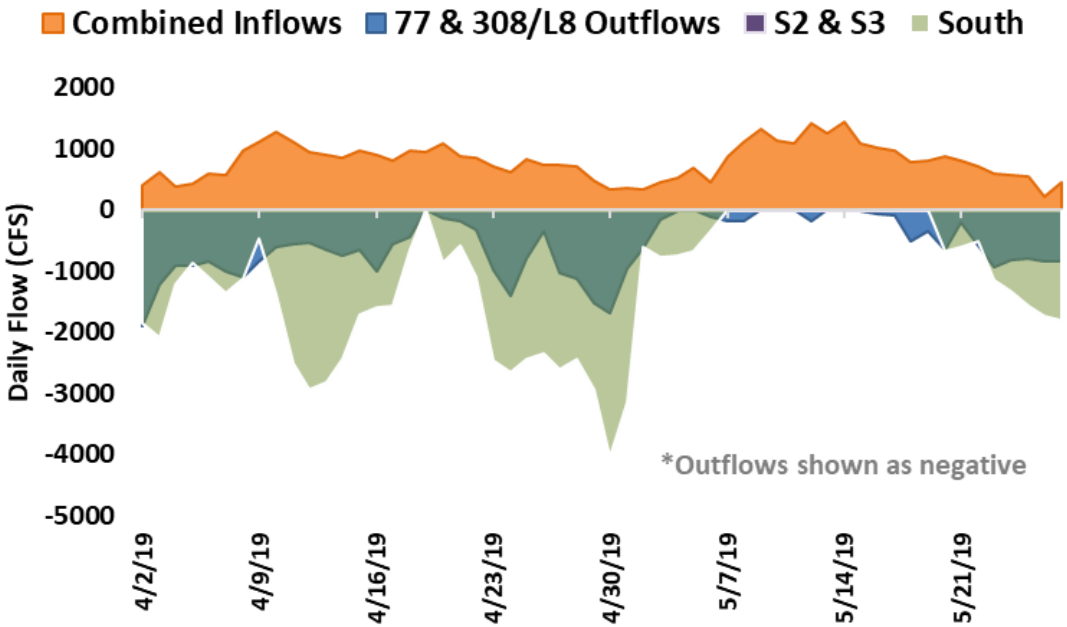


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes.

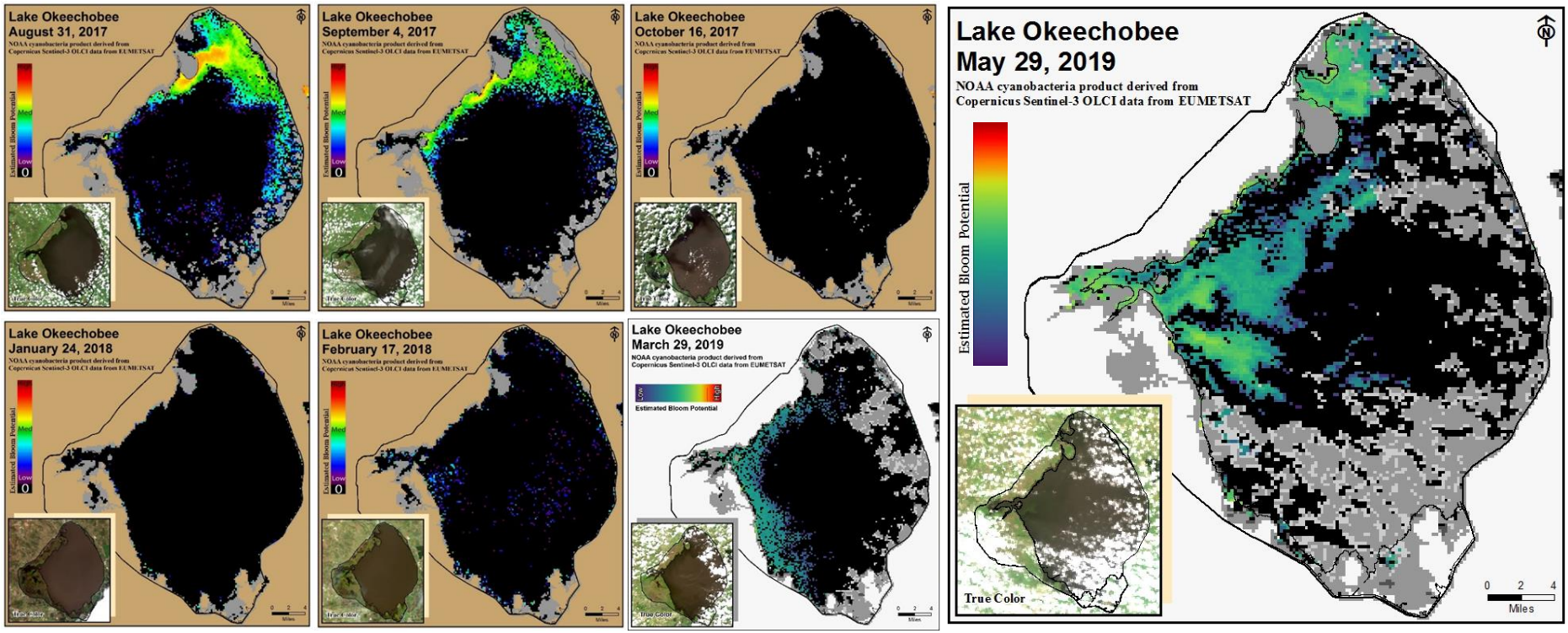


Figure 6. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. **Note** new color scale on larger image. Gray indicates cloud cover. All data are experimental and unvalidated at this point in product development.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 170 cfs (Figures 1 and 2) and last month inflow averaged about 432 cfs. Last week's provisional averaged inflows from the tidal basin and the structures are shown in Table 1.

Table 1. Weekly average inflows (data are provisional).

Location	Flow (cfs)
Tidal Basin Inflow	90
S-80	0
S-308	0
S-49 on C-24	0
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	80

Over the past week, surface salinity increased throughout the estuary (Table 2, Figures 3 and 4). The seven-day moving average of the water column (an average of the surface and bottom salinity) at the US1 Bridge is estimated to be 19.4. Salinity conditions in the middle estuary are within the good range for adult eastern oysters (Figure 3).

Table 2. Seven-day average salinity at three monitoring sites in the St. Lucie Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for adult eastern oysters (*Crassostrea virginica*) in the middle estuary.

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	**13.8** (13.3)	**16.3** (17.0)	NA[1]
US1 Bridge	**19.0** (18.3)	**19.8** (19.4)	10.0-26.0
A1A Bridge	**28.4** (27.2)	**30.4** (29.5)	NA[1]

[1]Envelope not applicable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 724 cfs (Figures 5 and 6) and last month inflow averaged about 1,130 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

Table 3. Weekly average inflows (data is provisional).

Location	Flow (cfs)
S-77	682
S-78	525
S-79	612
Tidal Basin Inflow	112

Over the past week, salinity increased throughout the estuary (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be within the good range for adult eastern oysters at Cape Coral and at Shell Point and in the fair range at Sanibel (Figure 9). The 30-day moving average surface salinity is 1.2 at Val I-75 and 7.0 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

Table 4. Seven-day average salinity at six monitoring stations in the Caloosahatchee Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for tape grass (*Vallisneria americana*) at Val I-75 and for adult eastern oysters (*Crassostrea virginica*) elsewhere.

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	**1.9** (NR[3])	**1.9** (NR)	NA[1]
Val I75	**1.5** (0.9)	**2.1** (1.1)	0.0-5.0[2]
Ft. Myers Yacht Basin	**7.9** (5.7)	**11.1** (7.1)	NA
Cape Coral	**NR** (13.8)	**18.2** (16.1)	10.0-30.0
Shell Point	**28.7** (NR)	**28.8** (NR)	10.0-30.0
Sanibel	**32.6** (31,7)	**32.7** (32.0)	10.0-30.0

[1]Envelope not applicable, [2]Envelope is based on a 30-day average, and [3]Not Reporting.

Forecast of surface salinity (Table 5 and Figure 10) at Val I-75 for the next two weeks using the autoregression model (Qiu and Wan, 2013) coupled with a linear reservoir model for the tidal basin predicts daily salinity ranging from 2.2 to 4.7 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 800 cfs and Tidal Basin inflows of 90 cfs.

Table 5. Predicted salinity at Val I-75 at the end of forecast period

Scenario	Q79 (cfs)	TB runoff (cfs)	Daily salinity	30 day mean
A	0	90	4.7	2.6
B	300	90	3.8	2.2
C	450	90	3.1	2.1
D	650	90	2.6	2.0
E	800	90	2.2	1.9

Red tide

The Florida Fish and Wildlife Research Institute reported on May 24, 2019, that *Karenia brevis, the Florida red tide dinoflagellate,* was observed at background concentrations in one samples collected from Lee and was not observed in samples collected from or offshore of St. Lucie, Martin, and Palm Beach counties (no samples from Miami-Dade or Broward counties).

Water Management Recommendations

Lake stage is in the Beneficial Use sub-band of 2008 LORS. Tributary hydrological conditions are normal. The 2008 LORS recommends no release at S-79 and S-80. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to areas further downstream.

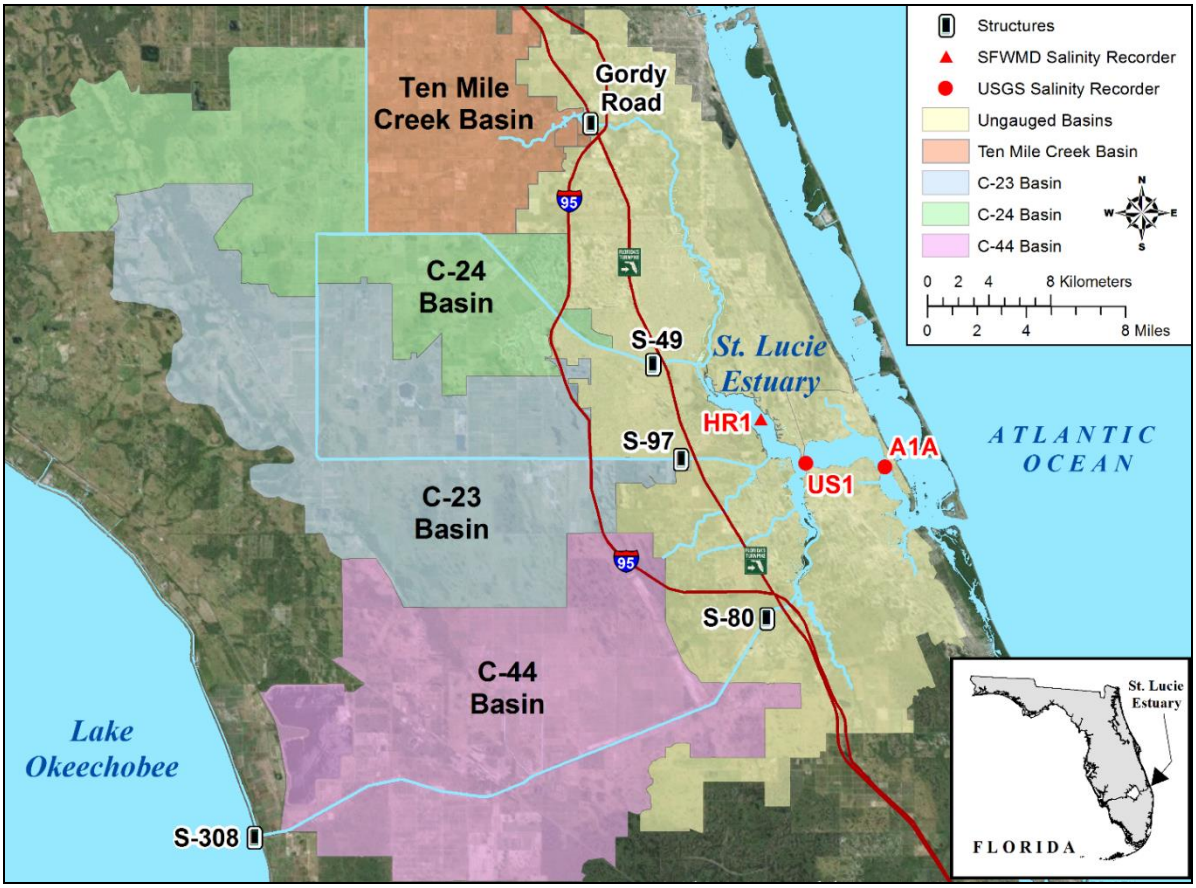


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

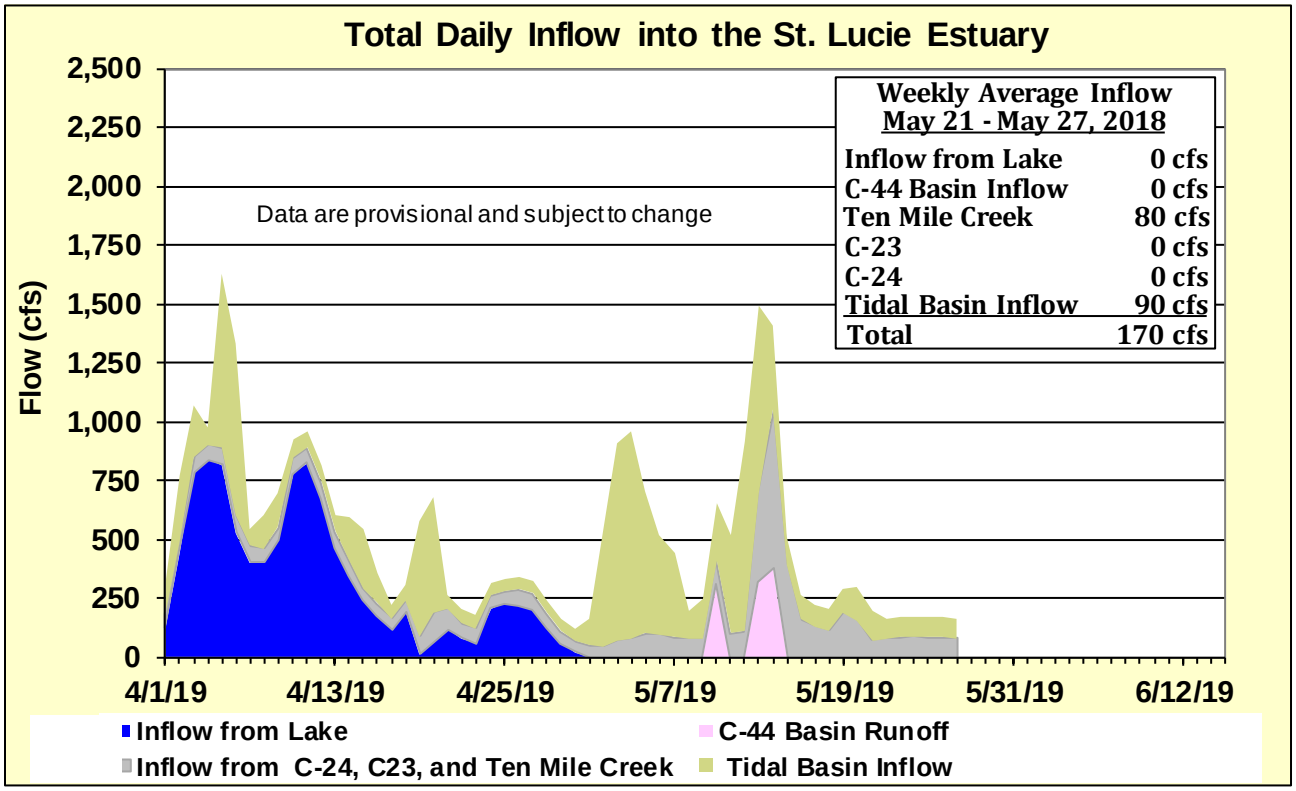


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

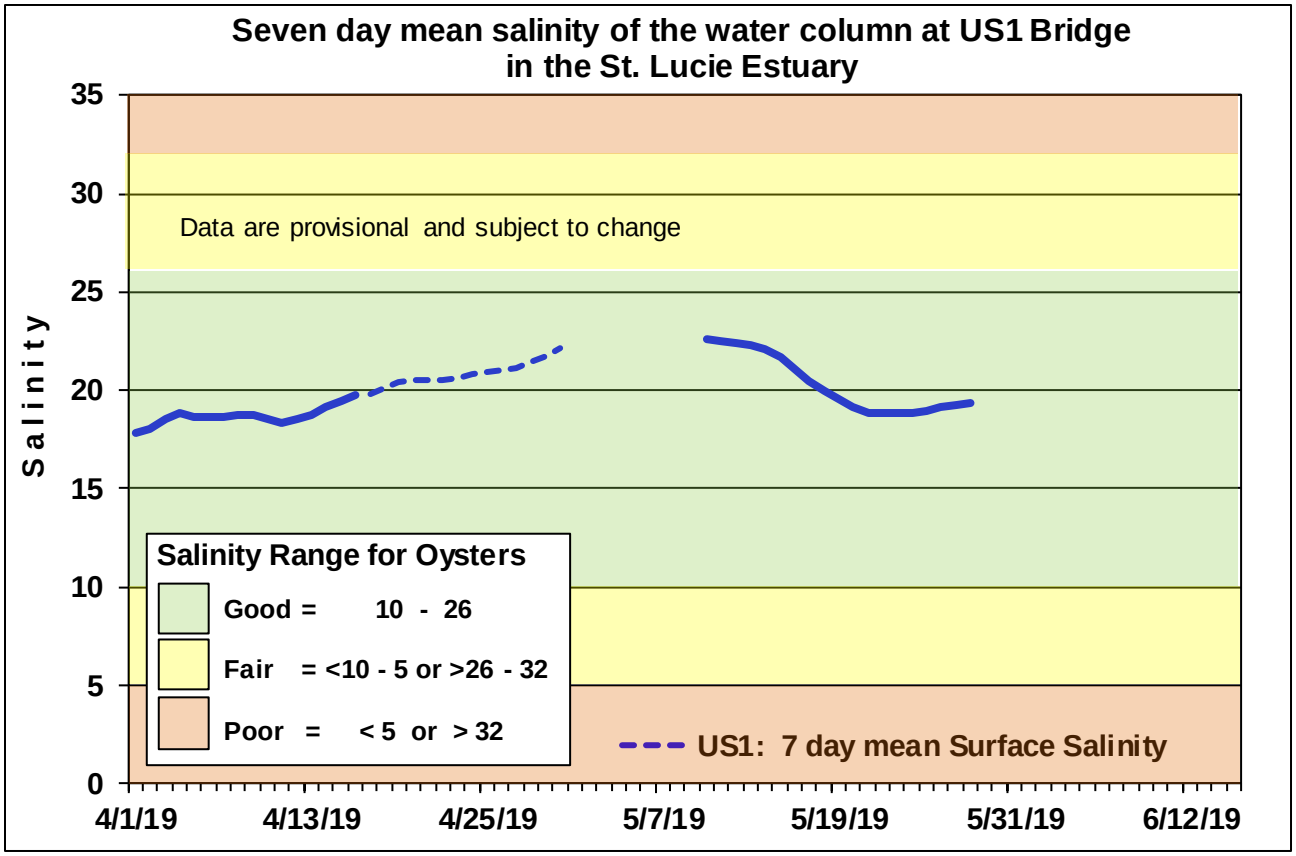


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

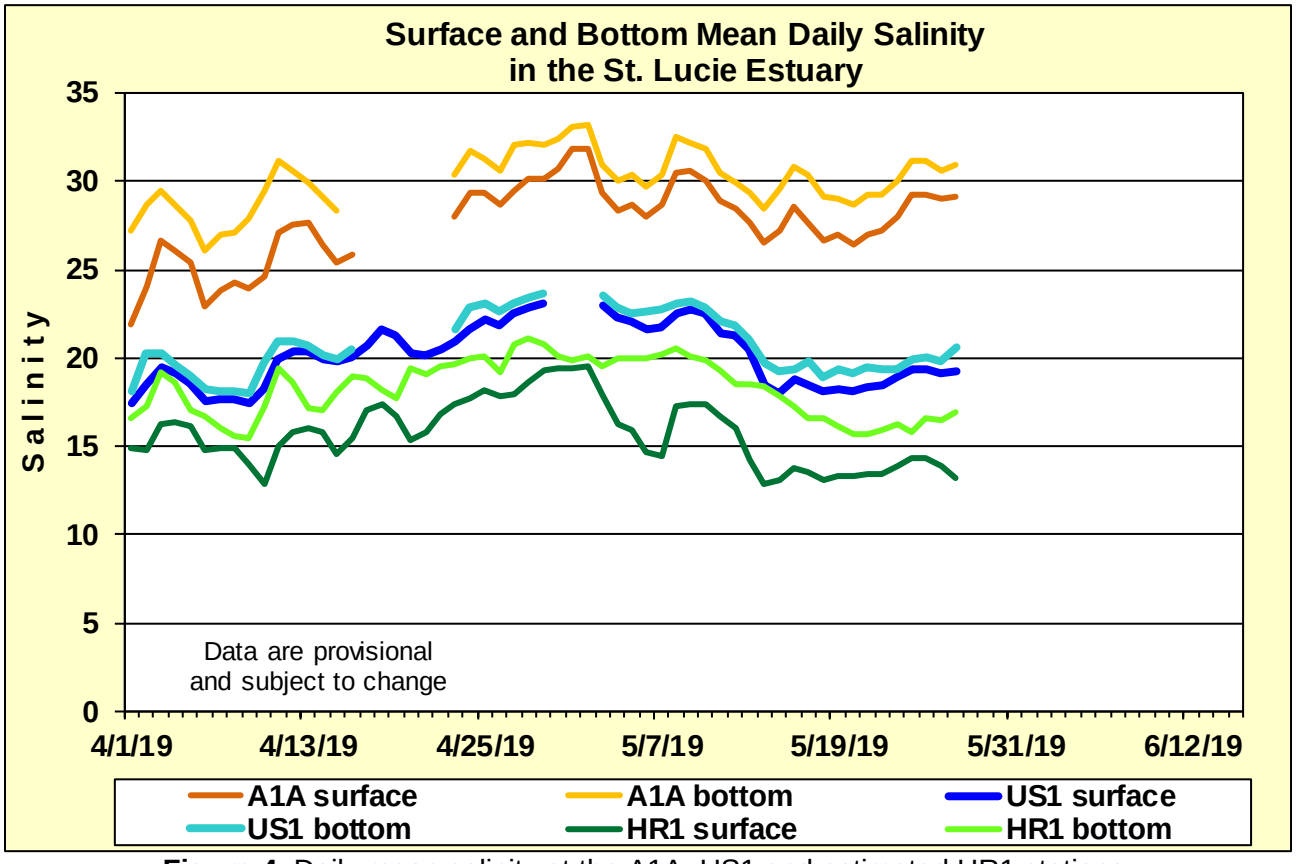


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

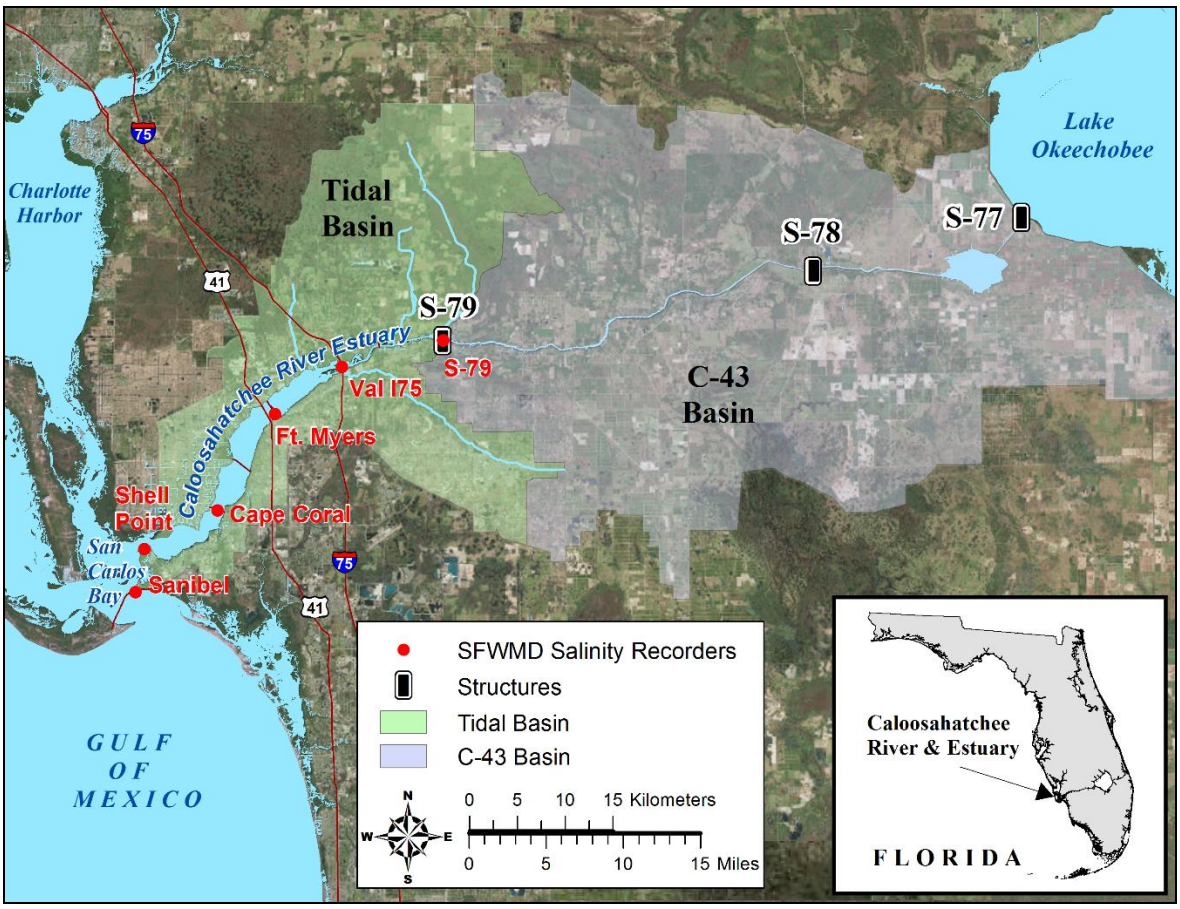


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

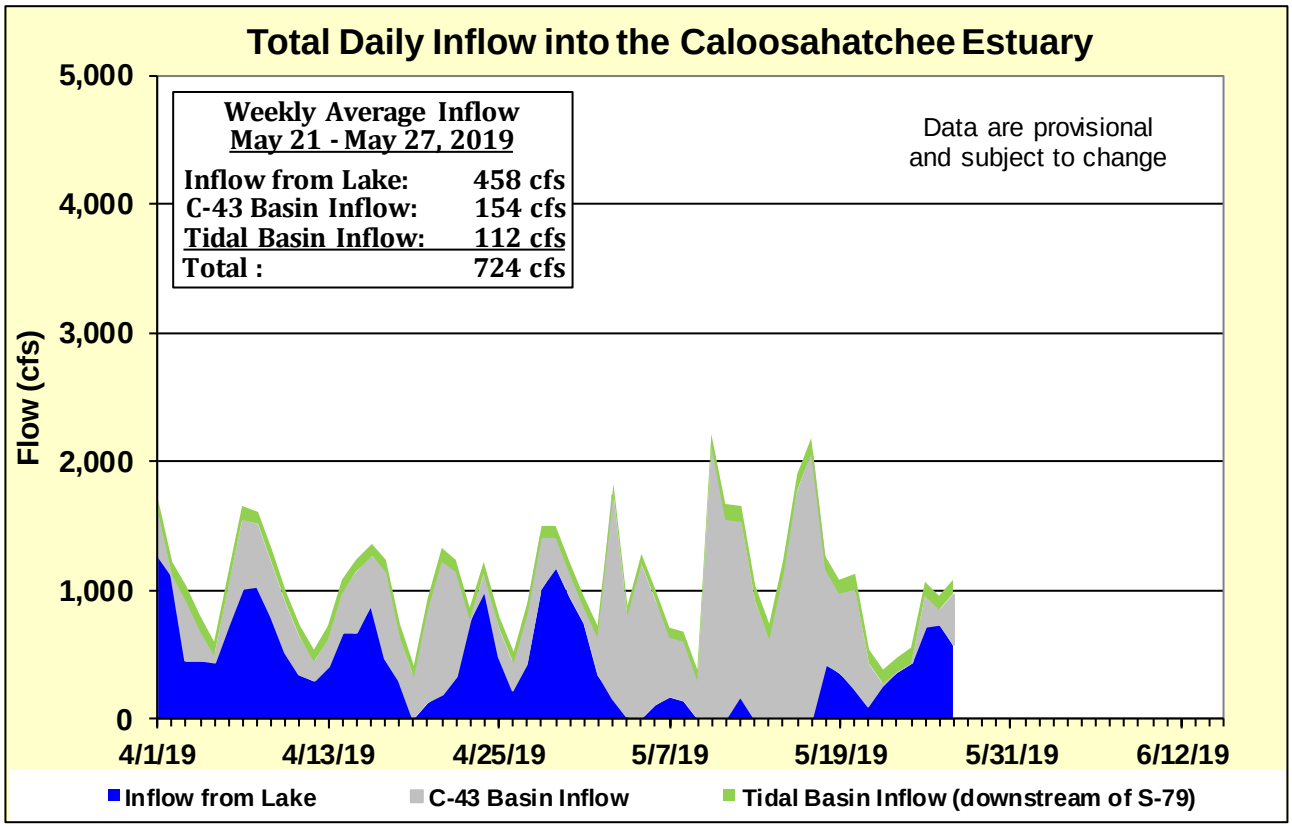


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

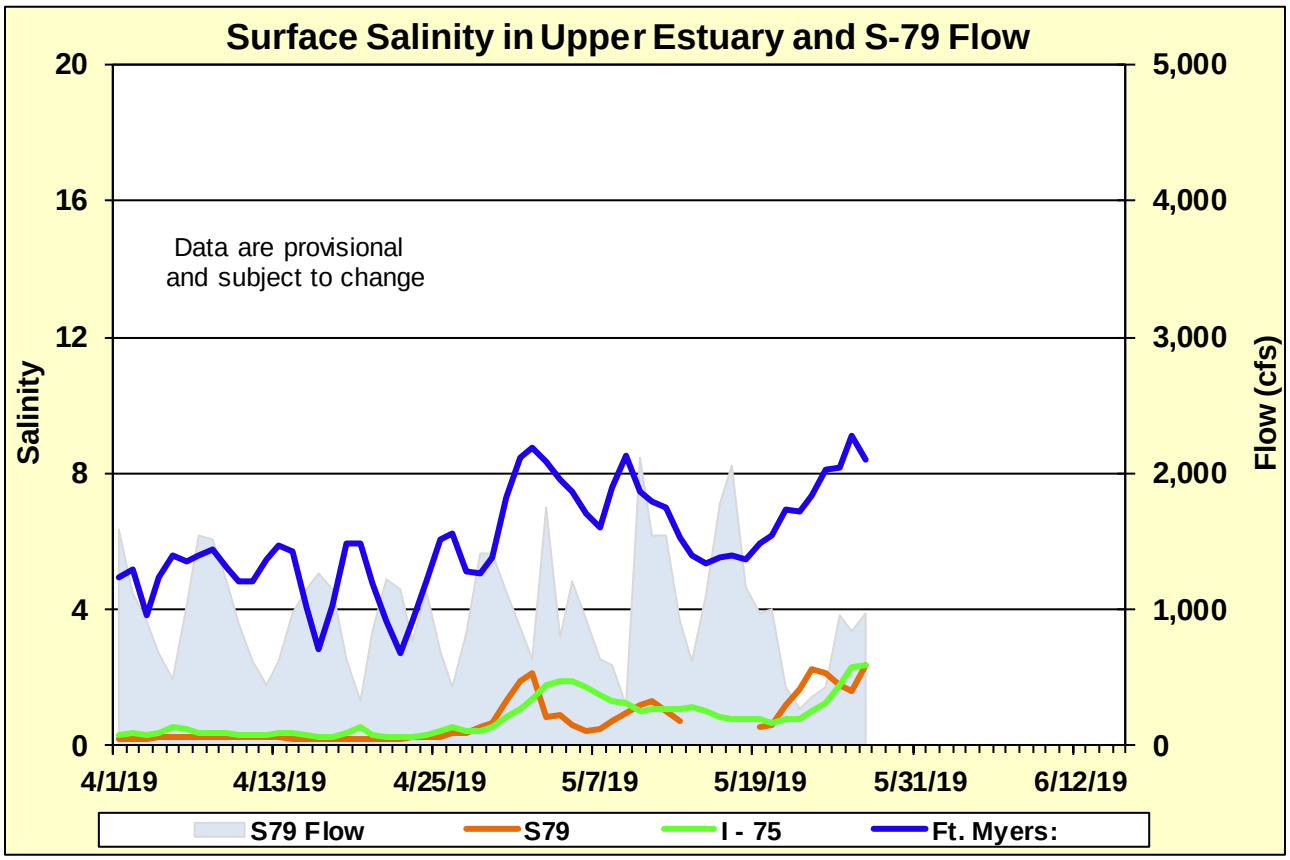


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

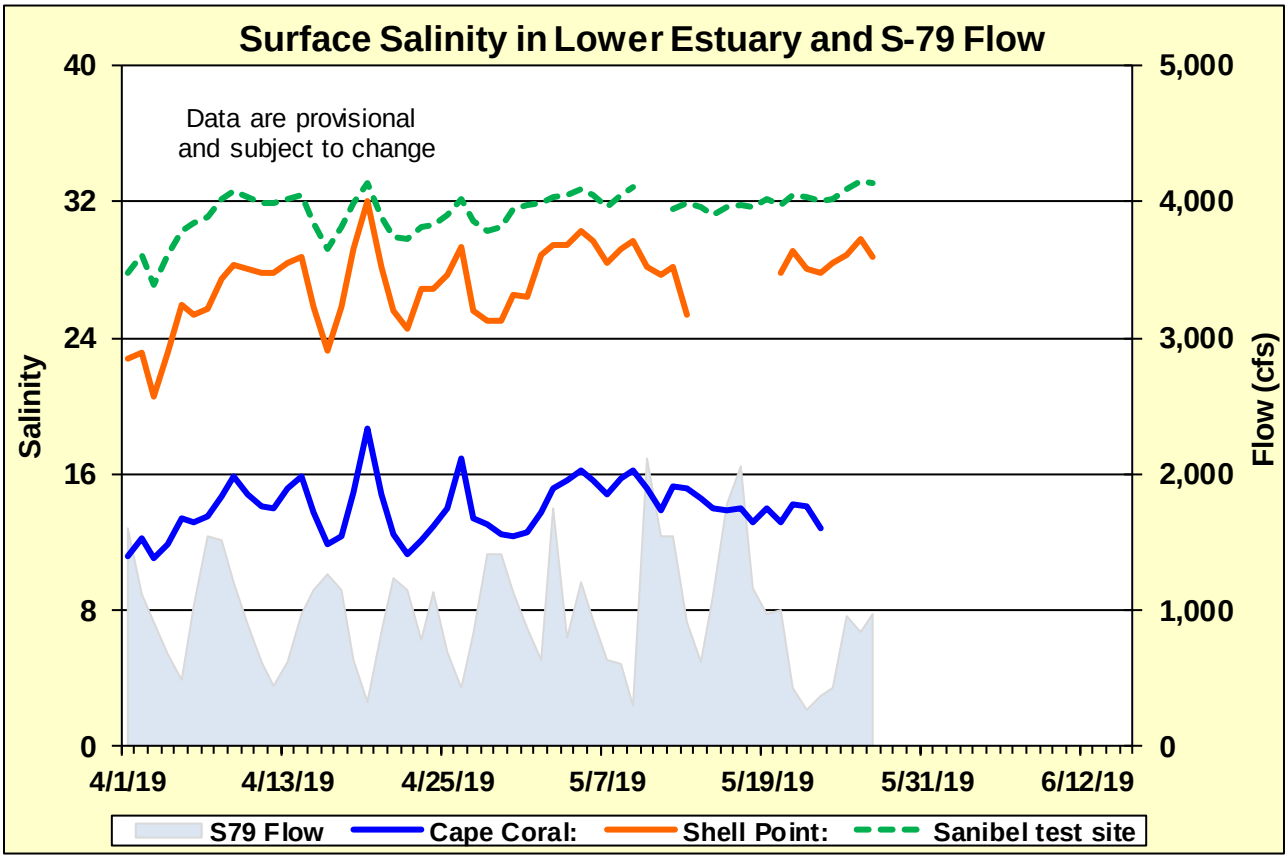


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

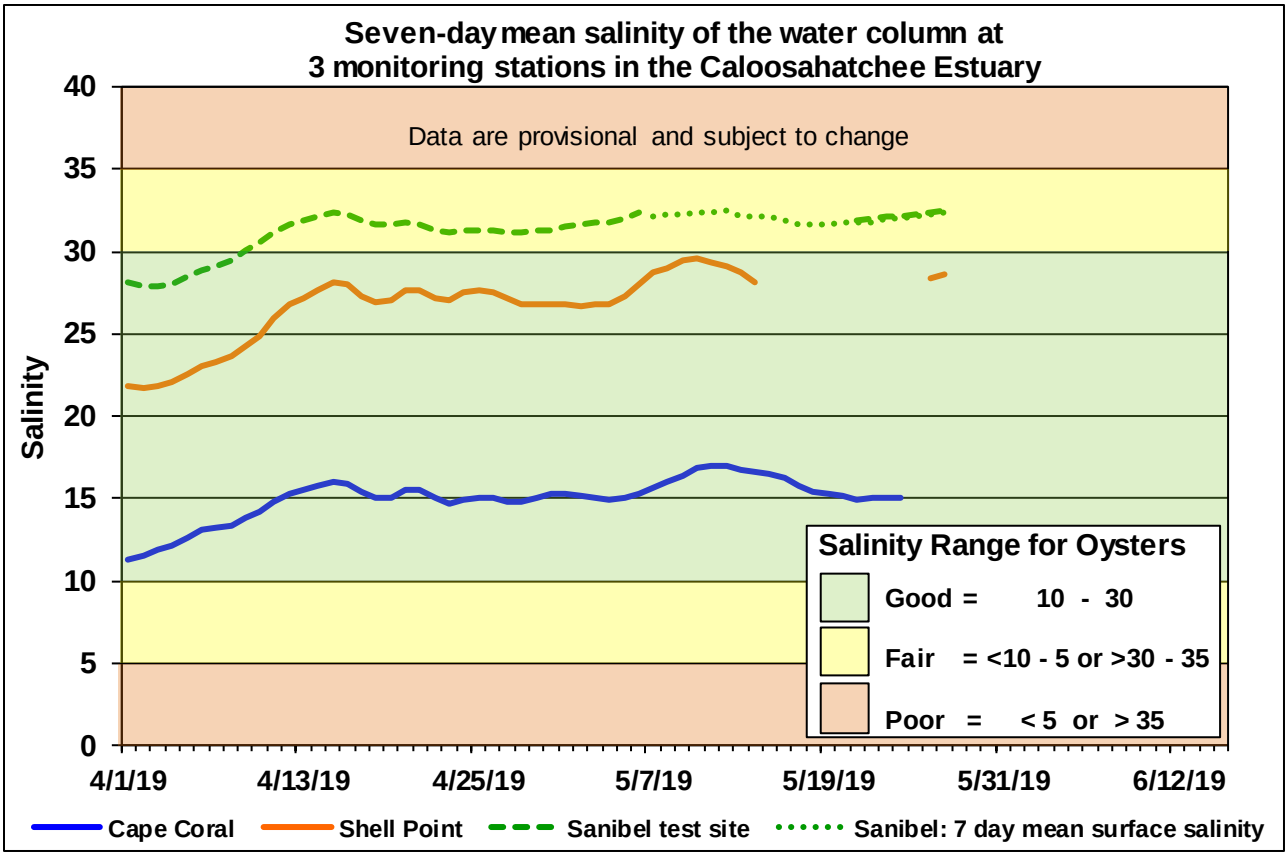


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

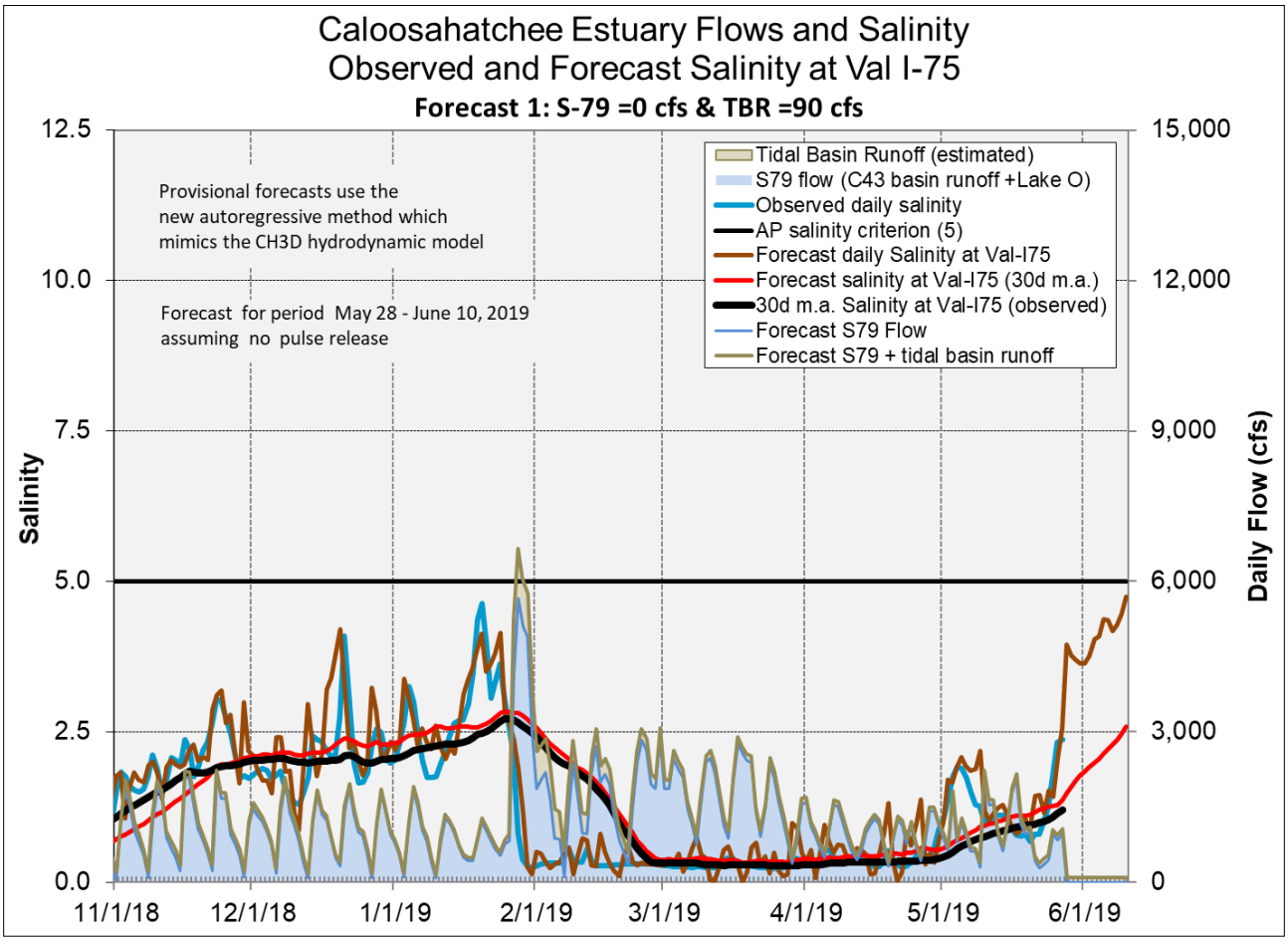


Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S-79.

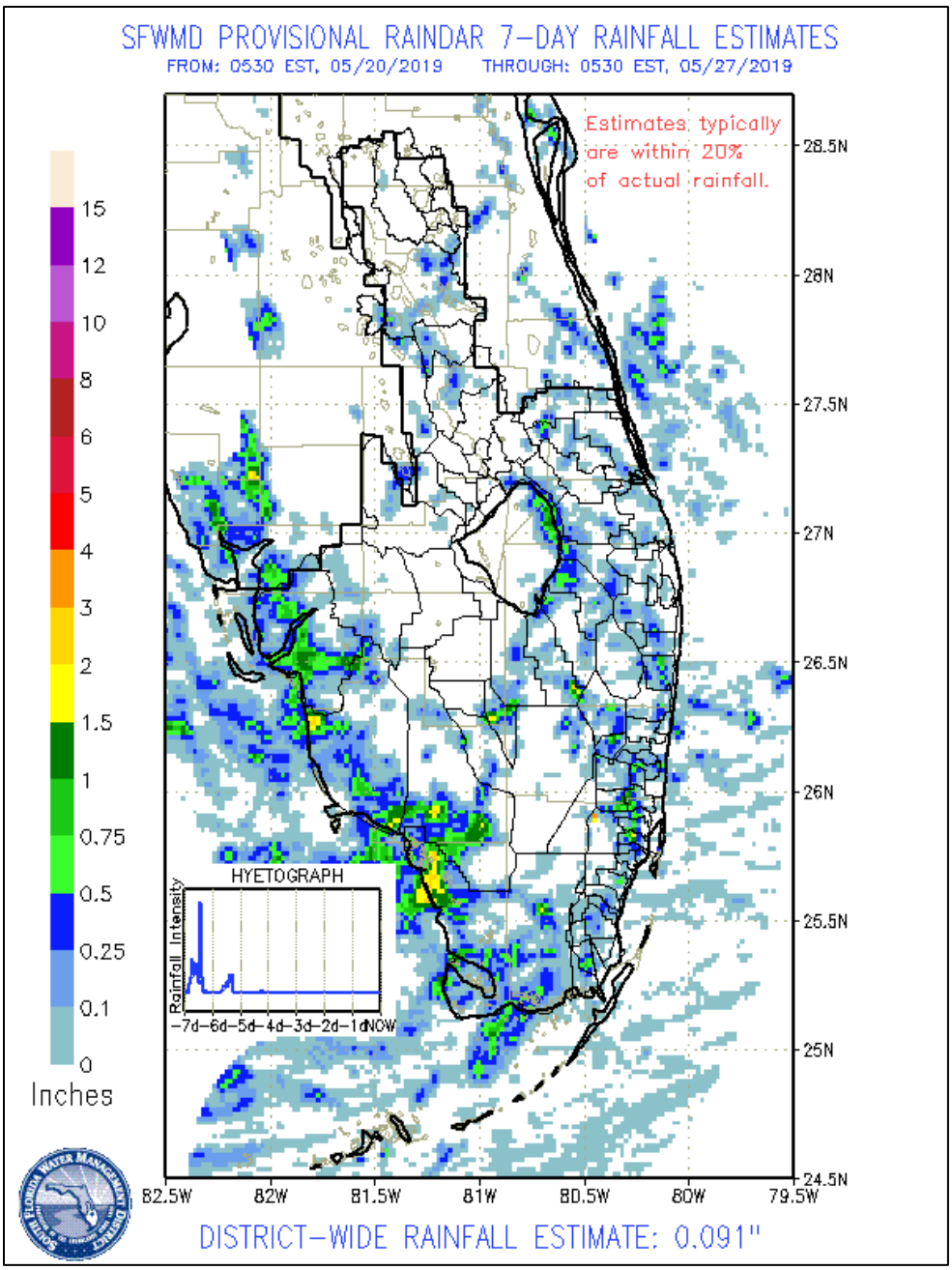
EVERGLADES

At the gauges monitored for this report the stages in the Everglades receded on average 0.11 feet last week. WCA-2A experienced a reversal at the 2-17-gauge location (central). The most extreme individual gauge changes ranged from +0.25 feet (WCA-2A) to -0.25 feet (WCA-1). Pan evaporation was estimated at 1.89 inches this week.

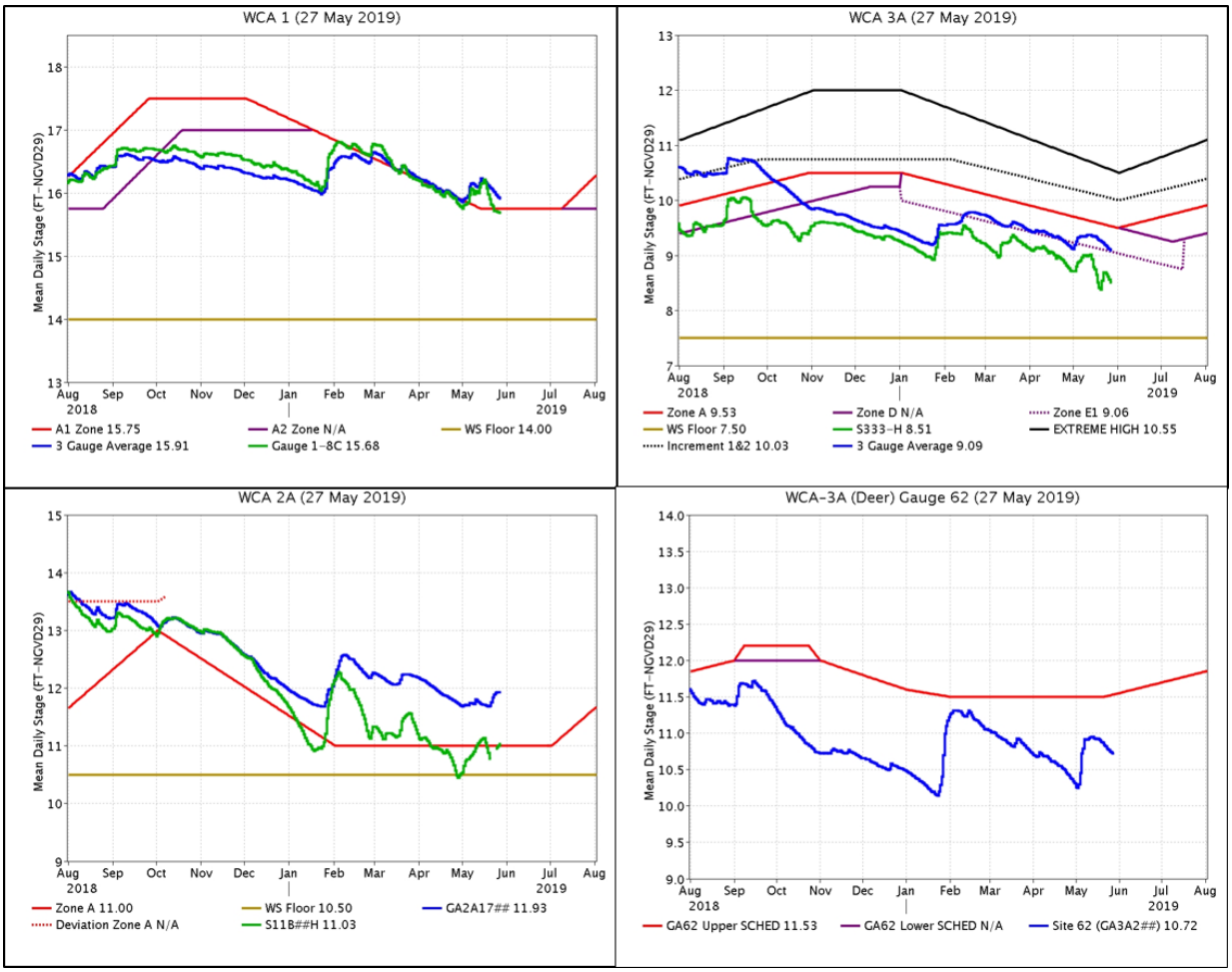
Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.02	−0.18
WCA-2A	0.13	+0.25
WCA-2B	0.33	−0.15
WCA-3A	0.03	−0.17
WCA-3B	<0.01	−0.10
ENP	0.07	+0.03

Good
Fair
Poor

Recession rate for wading bird foraging



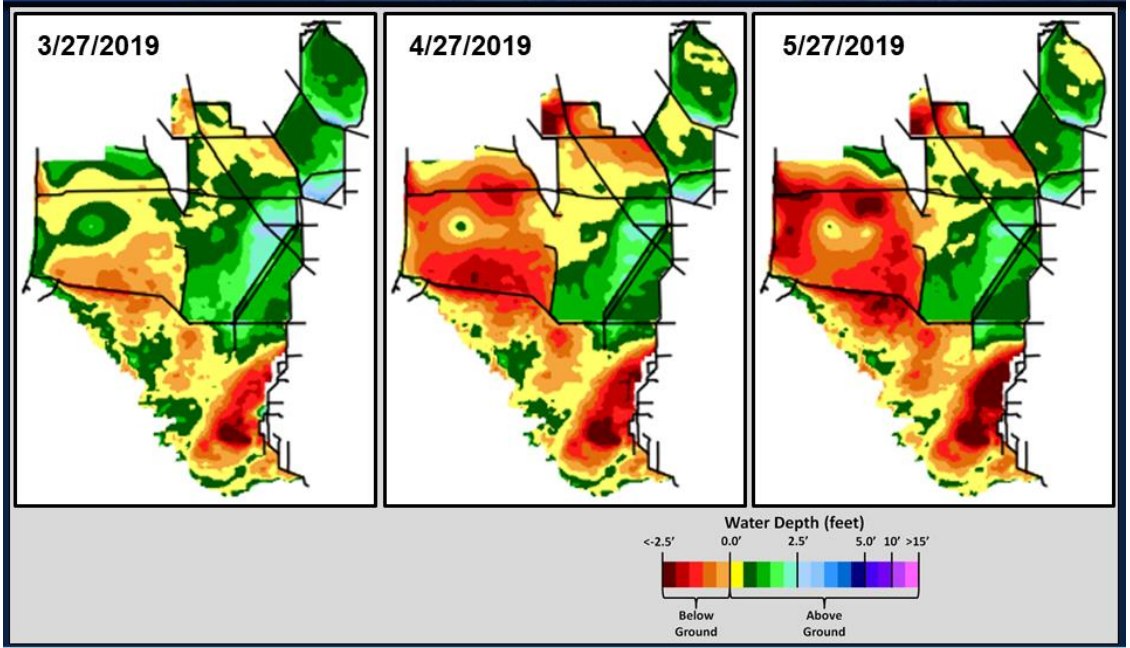
Regulation Schedules: WCA-1: Gauge 1-8C recedes towards regulation now 0.16 feet above the Zone A1 regulation line. WCA-2A: S-11B Headwater stage has risen steadily and is 0.03 feet above the Zone A regulation line.WCA-3A: The three-gauge average stage is 0.03 feet above Zone E1 regulation line. WCA-3A at gauge 62 (northwest corner) is 0.81 feet below the upper schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate stages in northeastern WCA-3A North remain below ground. Conditions in WCA-1 and WCA-2A look typical for this time of year. Stages are receding but remain above ground in Lostman's slough region. WDAT difference output indicates that water levels change within the WCAs over the last month were mixed and not significant. In the "1 Year" inset we see the difference between current depth conditions and those a year ago. A change in the map from a week ago; the current depths are significantly lower across the eastern WCA-3A, WCA-2A and WCA-1 compared to a year ago.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

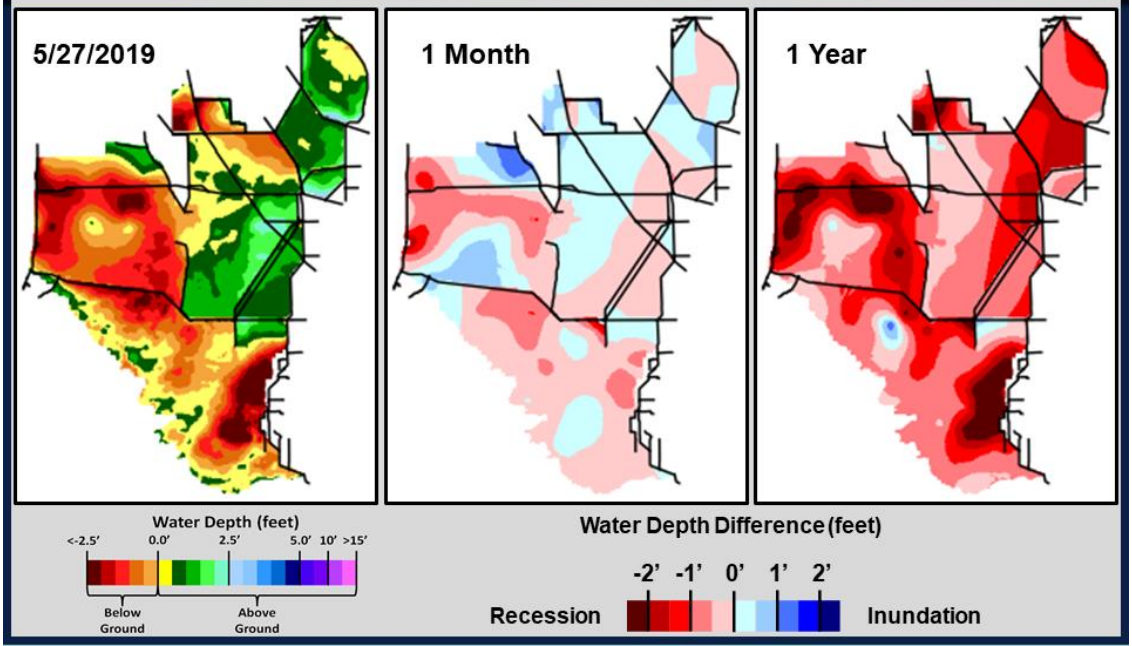
SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

SFWDAT Everglades Difference Maps (Present – Past)



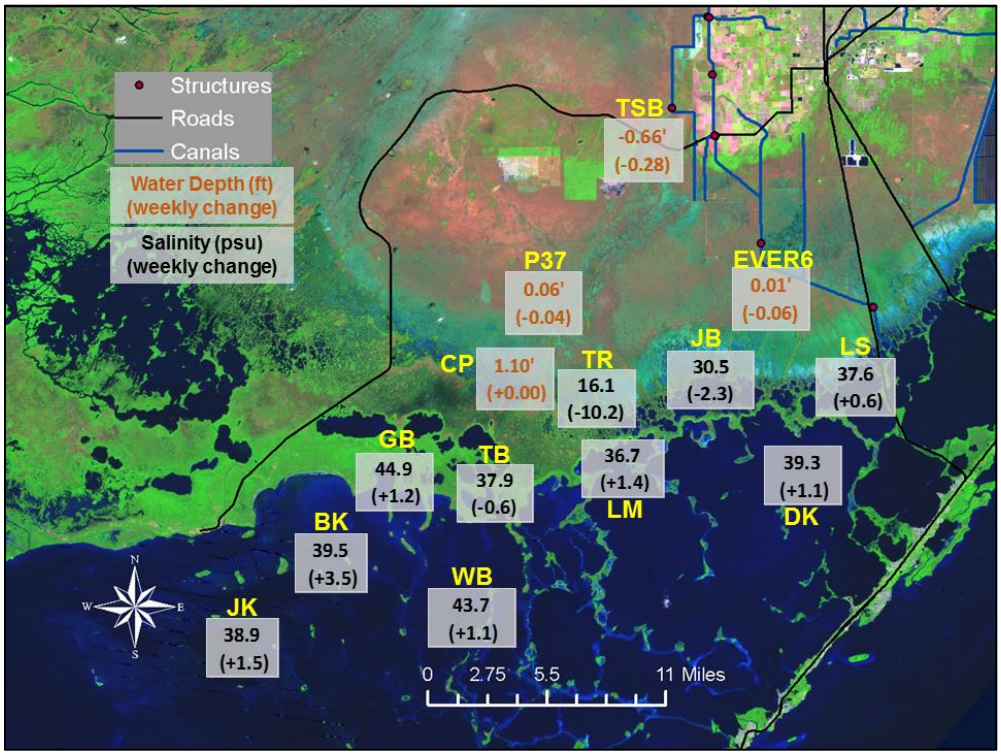
South Florida Water Depth Assessment Tool (SFWDAT)

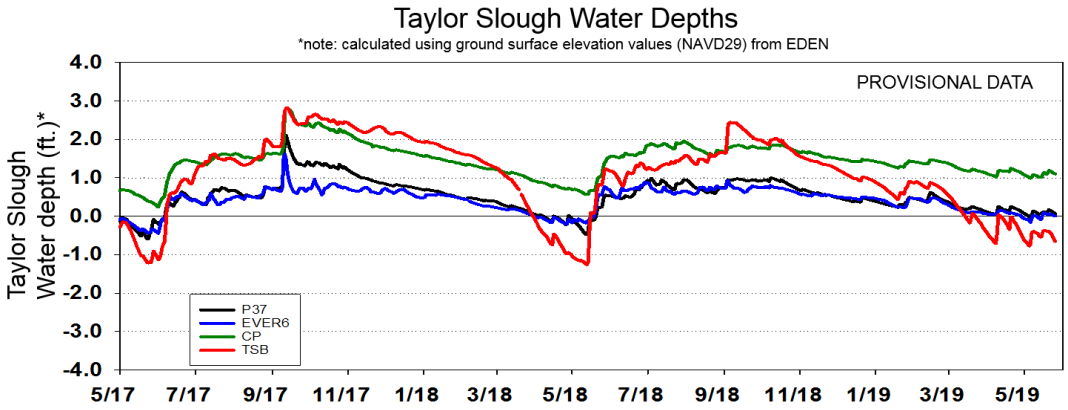
Wildlife Update bullets:

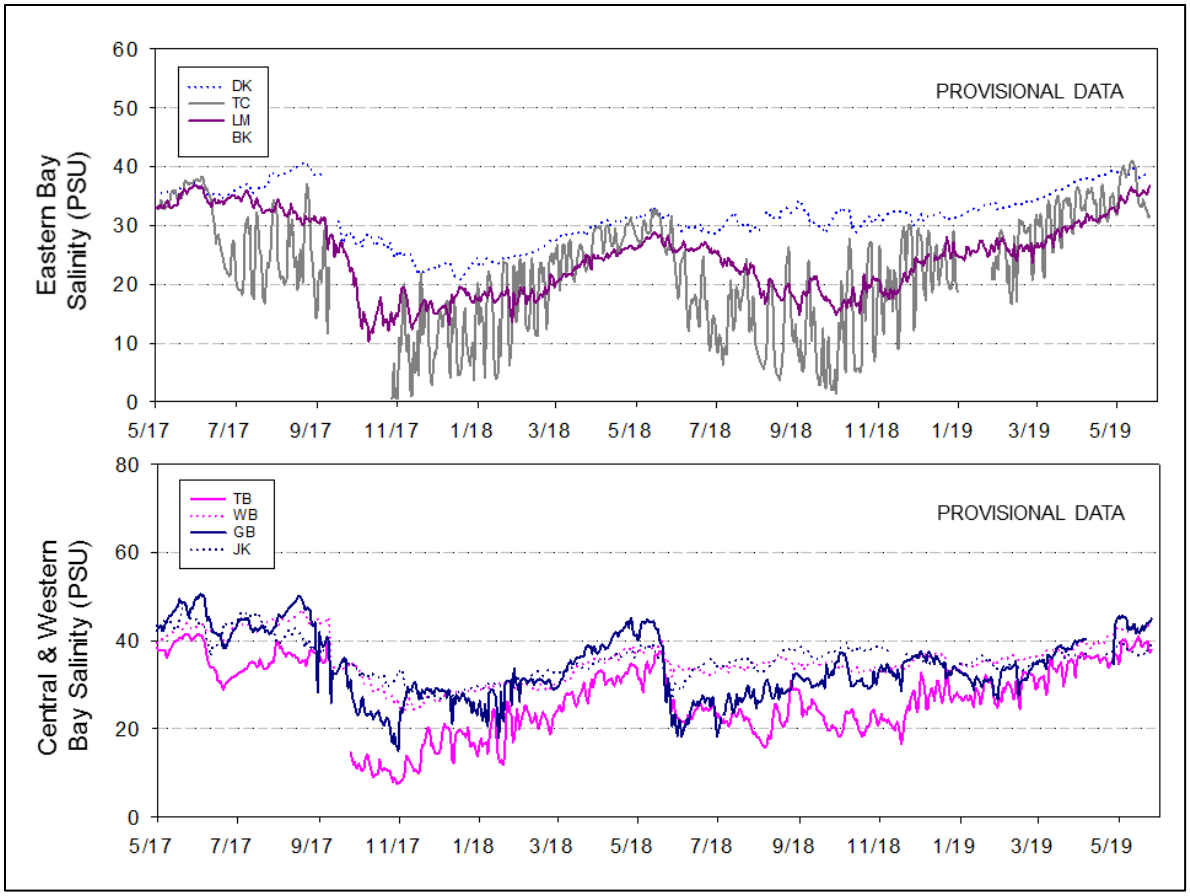
- Conditions look favorable for continued CSSS nesting, sub pop D breeding/nesting/fledging metrics continue to improve (noted as impressive in latest update)
- Large increase in the numbers of foraging wading birds in the Refuge (~ 3000 birds, mixed flock, located in central region and along the SW margin)
- Approximately 2,000 wading birds were feeding in mixed flocks throughout southwestern WCA-2A along US27
- Approximately 1,000 snowy egrets nesting in northeast WCA-1
- Significant increase in Everglades snail kite activity in southern WCA-3A, 23 total nests.

Taylor Slough Water Levels: Lack of rain this past week allowed water levels to decrease again. The average weekly decrease in water levels was 0.1 feet to leave the marsh area averaging a depth of 0.13 feet by Sunday. Northern Taylor Slough is the only area still below ground.

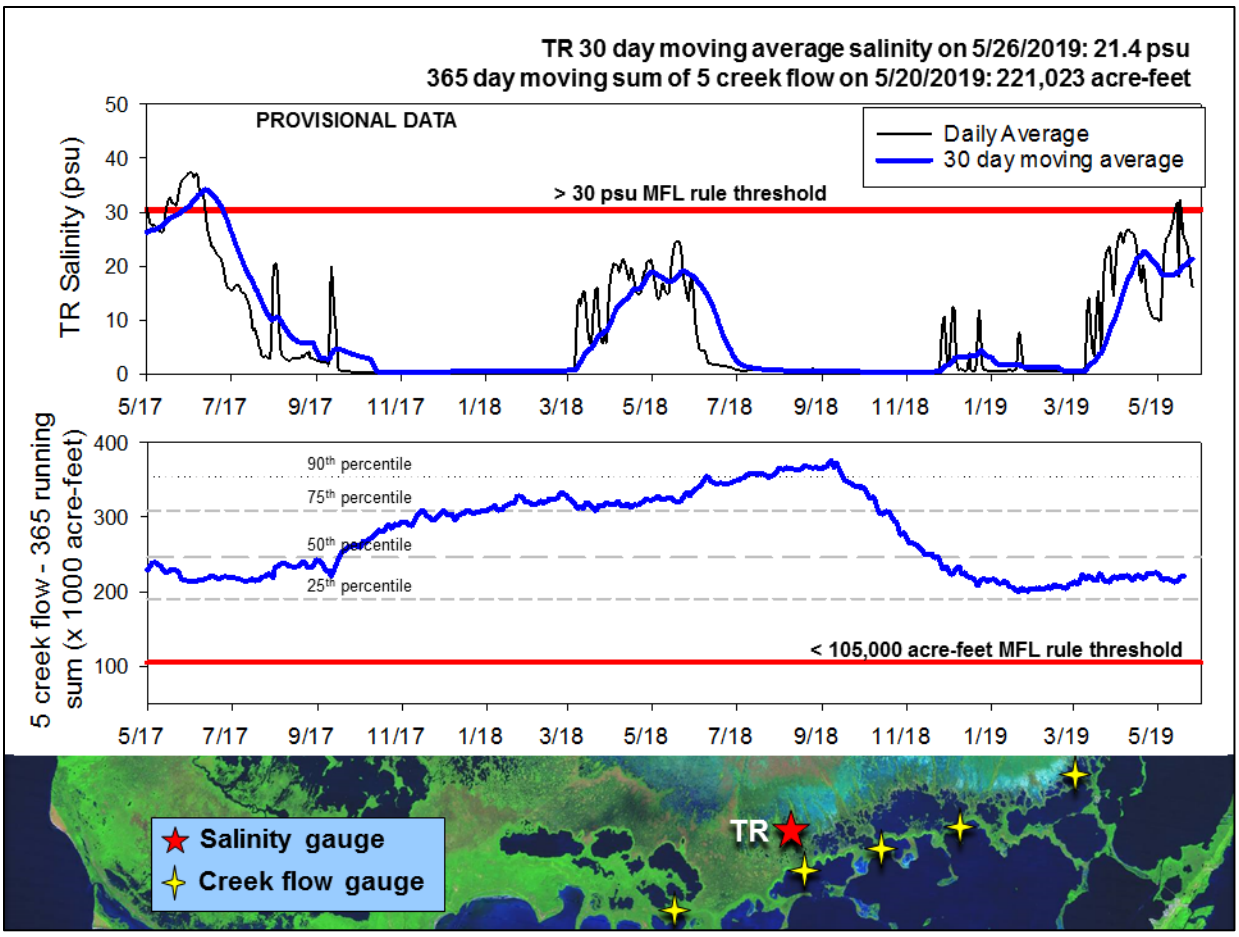
Florida Bay Salinities: Salinity in Florida Bay averaged a 0.8 psu increase from last week with only two stations showing a decrease over the week. The largest weekly increase in salinity (3.5 psu) occurred in the shallow bank area of western-central Florida Bay. Daily average salinities ranged from 31 psu in northeastern Florida Bay to 45 psu in the western nearshore area.







Florida Bay MFL: After salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) peaked at 32 last week, it decreased to 16 psu. The 30-day moving average increased to 21.4 psu. The eastern most creek of the five creeks tracked as part of the Florida Bay MFL criteria stopped reporting last week and this hasn't yet been resolved. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) was 221,023 acre-feet on 5/20 which is the last day for which data were available. This is less than the long-term average of 257,628 acre-feet, but above the 25th percentile. Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Wading bird nesting remains uncertain in the WCAs. Wading bird flocks were observed foraging in western WCA-2A and WCA-1 on 5/28/19. Nesting flights of the WCAs will be conducted next week. Expectations for nesting success at the Alley North Colony is low, however the numbers of nesting birds are increasing in WCA-1. Moderating any reversals and maintaining near optimal recession rates in WCA-2A and WCA-1 will have ecological benefit throughout what remains of the wading bird nesting season. If dry season climatic conditions continue, WCA-3A South could be another important area for wading bird foraging, the current stage there as predicted by EDEN is just at or above the optimal depth. Recent Everglades Snail Kite activity remains high in southern WCA-3A. Slowing the recession rate in that area (gauge 65 near that area receded 0.17 feet last week) would have an ecological benefit for both kite nesting and wading bird foraging. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, May 28th, 2019 (red is new)			
Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.18'	Maintain depths near regulation schedule. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect upstream/downstream habitat and wildlife.
WCA-2A	Stage increased by 0.25'	Maintain depths at regulation schedule. Moderate reversals when possible. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-2B	Stage decreased by 0.15'	Maintain depths at regulation schedule. Maintain recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.21'	Maintain depths at regulation schedule.	Protect habitat including peat soil development and wildlife. Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-3A NW	Stage decreased by 0.16'	Maintain depths at regulation schedule.	
Central WCA-3A S	Stage decreased by 0.15'	Maintain depths at regulation schedule. Manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions that provide wading bird foraging habitat later into the nesting season.
Southern WCA-3A S	Stage decreased by 0.17'		
WCA-3B	Stage decreased by 0.10'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage increased by 0.03'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from −0.28' to +0.00'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions. Decrease potential for high phosphorus input to ENP.
FB- Salinity	Salinity changes ranged −2.3 to +3.5 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.